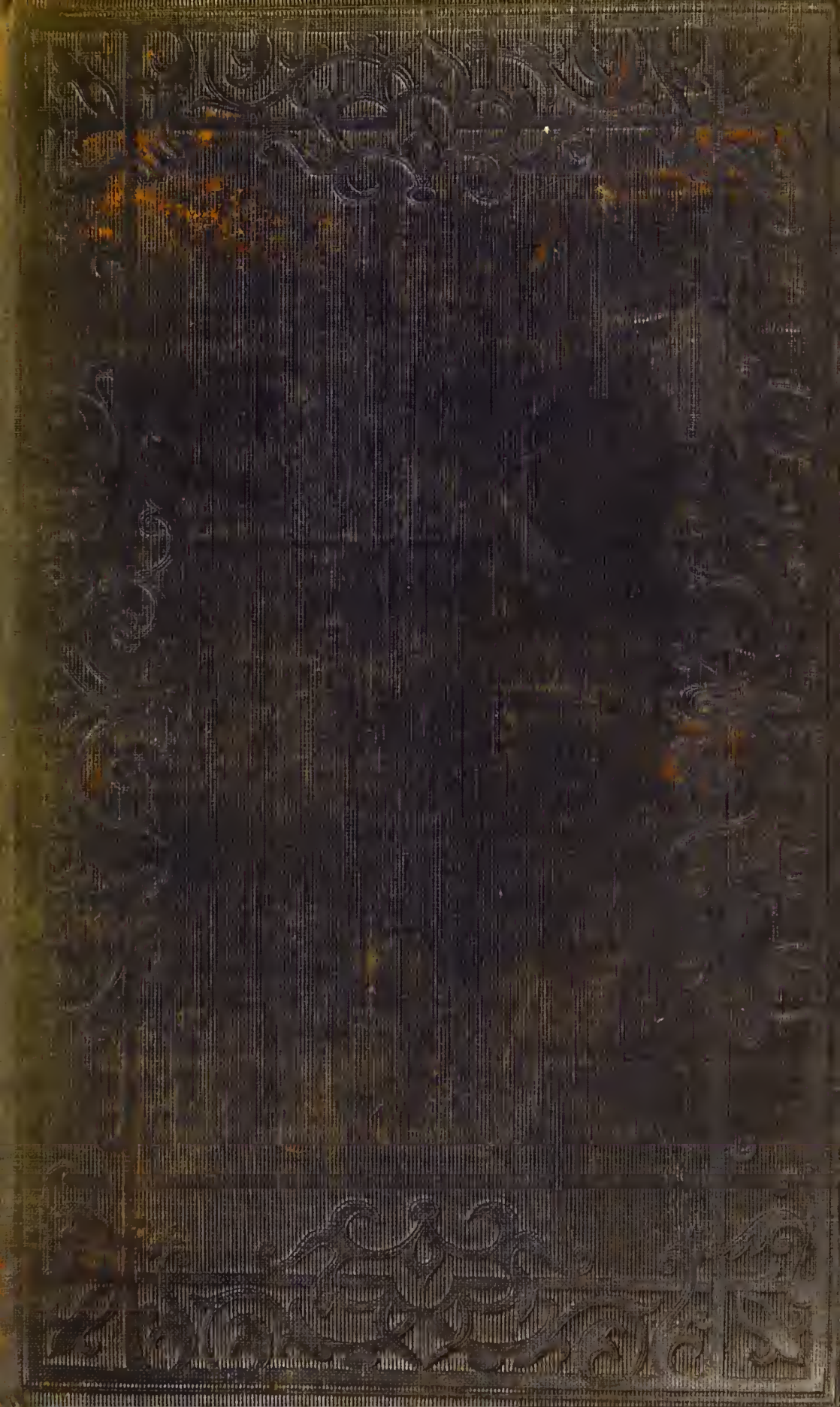




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ERRATA.

Vol. I., page 182, line 4 from bottom, *for* "Prout's," *read* "Proust's."

Vol. I., page 318, line 5 from top, *for* "ten," *read* "sixteen."

A TREATISE

ON

DIET AND REGIMEN.

CHAPTER III.

On Muscular Exercise.—Muscular Action.—Expenditure caused by Muscular Action.—Mechanical Effect of Muscular Action.—Effect of Muscular Exercise on Nutrition.—Effect of Muscular Exercise on Respiration.—Importance of using all the Muscles.—Different Means of Muscular Exercise: Hand-Swings, Dumb-Bells, Hindostanee Clubs, the Skipping-Rope.—Exercise Neglected in an especial degree by Women.—Deductions as to Hereditary Predisposition to Physical and Constitutional Characters, and the consequent Healthiness or otherwise of the system, as illustrating and enforcing the importance of Muscular Exercise.—Peculiar Importance of Exercise in the Years of Growth.—Dancing, as a means of Exercise.—Use all the Muscles.—Exercise in the Open Air to be preferred.—Walking.—Walking *versus* Carriage-Exercise.—Riding.—Sailing.—Exercise of the Voice.—Adaptation of Exercise to Mental Character, Age, Sex, Habits, and Strength.—Effect of Mind on the Degree and Effects of Muscular Exercise.—Adaptation of Exercise to different Morbid Conditions of the System.—Effects of Systematic Training, in illustration of the Importance and Influence of Muscular Exercise.—Summary.

MUSCULAR action forms one of the principal sources of expenditure to the animal economy. The

contraction of the fibres of the muscles of the body involves a proportional waste or expenditure of certain of their organic atoms, the resolution of such atoms into new and simpler forms of composition, and (having thus ceased to be an integrant part of the living system) the necessity of their excretion from the body; the loss thus sustained being compensated by the introduction of new organisable atoms, by means of the digestive or assimilating functions. The moving apparatus of the body is only second to the function of respiration in the amount of its expenditure; and yet much of the expenditure occasioned by muscular contraction appears to subserve immediately the respiratory function, by enabling the oxygen to derive the necessary carbon, in some degree, from the detached and excrementitious atoms of the living organism. Much of the carbon required for the calorifiant wants of the system appears, however, to be derived directly from the alimentary supplies, and their instant decomposition, and the consumption of their constituent carbon; and thus, although demanding and using the larger proportion of the alimentary supplies, the function of respiration does not appear to involve by any means so large a direct expenditure of the already organised atoms of the body, as results from the action of the muscular system. It is indeed true, that, if such aliment is not afforded to the body, as is capable of furnishing carbon to the function of respiration without the complete disintegration of its atoms, and the disengagement of a large proportion of nitrogen,

muscular action may become almost needful to the calorifiant wants of the system, and largely subvenient to them. Under such circumstances, muscular action may be greatly useful to the general economy of the body, not only by the expenditure and removal of the waste and redundant matters, but by a direct ministration of the needful carbon for the respiratory wants. When the carbon required for the purposes of respiration is in a great degree supplied by the use of non-azotised articles of food, muscular action becomes less needful as regards this particular; and its principal use may be, to ensure such an expenditure of the waste of the body, as may effect the timely renewal of the organic atoms, and secure the integrity and soundness of all the organs and structures,—and, moreover, such an expenditure, as may obviate either local or general plethora, and maintain the due balance of the different bodily functions.

Muscular action, involving the contraction of fibres, and consequent movement of attached or adjacent parts or structures, comprises all the apparatus of movement possessed by the animal machine, and includes the muscles of involuntary as well as those of voluntary motion. It is principally to the effects of the exercise of the voluntary muscles, that I am now about to refer. It may be useful to attempt to specify more particularly the effects on the economy of the system, of the exercise of the voluntary muscles, preliminary to a practical consideration of the various kinds of exercise, and their adaptation to the various and varying requirements and conditions of the body.

4 EXPENDITURE CAUSED BY MUSCULAR ACTION.

Exercise (the movement of any part of the body at the command of the will) is produced by contraction of the muscles of voluntary motion, and their alternate relaxation. For, although muscular contraction may be considered to be exercise, in the strict sense of the word; and although, when not alternated with relaxation, such contraction constitutes the most fatiguing way in which the muscles can be made use of; yet, in the more ordinary sense, muscular exercise implies a series of consecutive movements, involving and produced by alternating contraction and relaxation of the muscular fibres. So true is it, that muscular contraction, without such intervals of relaxation, is especially fatiguing (a fact, however, of which any one may be convinced, by attempting to hold the arms extended for more than a very few minutes at a time), that the extensor muscles are less powerful than the flexor muscles of the limbs, in order to secure the more complete repose of the body when not engaged in active exertion.

The use of the muscles of voluntary motion must be preceded by so much of nervous influence being directed to them, as may serve the purpose of a stimulus to the fibres called into action; and this must involve a corresponding expenditure of nervous power, and a corresponding and simultaneous expenditure of the organised atoms of the nervous system itself: a preliminary condition, and source of additional expenditure, beyond that involved in the muscular contraction, which has been already noticed.

Every action of the animal economy occasions an expenditure of some portion of its living organism; the atoms so expended undergoing important chemical changes; and either becoming directly excrementitious,—or ministering, in the first instance, to the formation of secretions, which have ulterior uses to subserve,—or being resolved into nitrogenised matter, which becomes effete, and carbonaceous matter, which ministers to the demands of respiration.

Muscular contraction affects and alters the relative position and form of the fibres, in regard to one another, and in regard to the surrounding parts. The length of the muscle is diminished, and its width is increased; and a large amount of pressure is thereby exerted on the interstitial spaces between the fibres, and on the structures immediately around them. The mechanical effect of this pressure on all the capillary vessels, so liberally, minutely, and universally interspersed and distributed through all the tissues and structures,—constituting in fact a very large proportion of their substance, and filled with a fluid which is impelled a tergo by the action of the heart, and the contractile or elastic action of the larger arteries, to move in one direction, viz. from the heart to the minutest ramifications of the arterial system, where these infinitely small branches terminate in the veins,—must be to aid in driving the current of blood onward more rapidly in its destined course, to quicken the action of the vessels of the part by the extra stimulus of the more rapid current of blood, and to increase the amount of whatever

vital processes are accomplished in the respective structures by the passage of the blood through them, and by the chemical alterations in the blood which occur in its transmission through and from the arterial into the venous capillaries; these changes embracing the disengagement of certain of the organisable atoms from the current of the circulation, and their deposition and conversion into such portions of the organism as require additions or repair, from the expenditure that is consequent upon every action and process of the economy,—the removal of the expended atoms,—the formation of any required new combinations of their elements, or of the elements of the blood itself, for ulterior uses in the system (secretion),—the taking away of such effete matters as have, as soon as possible, to be removed and conveyed out of the body (excretion),—and the conversion of the arterial into venous blood, involving the combination of oxygen (obtained by respiration, and carried to the capillaries in the red particles of the blood) with the carbon (obtained from the destruction of tissue, or directly from the food), and the proportional evolution of heat. It follows from this, that, among the necessary results of muscular exercise, the powers of the nervous system are by so much expended,—the expenditure of nitrogen is by so much increased,—the circulation of the blood is by so much quickened, or at least rendered more energetic,—the secretions and excretions are promoted,—the waste and expenditure of the system in these ways largely added to,—and the animal heat

augmented; and all this, on intelligible and admitted principles.

The muscular fibres made use of are increased in size and power, in some degree of proportion to the amount of use made of them; all the vital processes going on in their tissue more rapidly, as well those of production as those of expenditure. And not only are the organic processes performed more quickly and vigorously in the tissue of the moving fibres themselves, or in the structures that are in their immediate vicinity; but all the processes of the economy, remote as well as contiguous,—the power and quickness of the general circulation of the blood; the equal distribution of the blood throughout the system; the amount of secretion and excretion from it,—are, as has been said, all added to. And thus, the vigorous action of the secreting organs of the stomach, and the consequent healthiness of the gastric and peptic secretions,—thus, the due solution and chymification of the food,—thus, the character and amount of the hepatic secretion,—thus, the healthiness and amount of mucus secreted from the whole lining membrane of the food and air passages,—thus, the separation of the chyle from the chyme,—thus, the conveyance of the chyle, by means of the lacteals and thoracic duct, to the subclavian vein, and the compensation, by the addition of newly-organised atoms, for the expenditure of the system,—all come to be indirectly promoted by muscular exercise of the trunk and extremities. In the same way, the action of the skin, the kidneys, and other

emunctories of the body, is promoted by the quickened and more efficient passage of blood through their several textures; and muscular exercise is made to subserve, in a large degree, not only the expenditure and reproduction of the moving apparatus itself, but the wear and tear, and renewal, of every part of the system. But even this is not all the good effect of muscular exercise; for, as a consequence of this, the circulation of the blood being equalised, partial distributions of it and local congestions are prevented. This effect is very much promoted by the effect of exercise in determining the blood to the whole of the surface of the body,—independently of the ulterior and important influence of the augmented secretion from the skin on the expenditure of the system. It is needful to add to all that has been stated, that, by the increased rapidity with which the blood is made to circulate through the vessels of the brain, the tone and capabilities of the mind itself, by virtue of the marvellous and inexplicable connection and mutual dependance of mind and body, may be said to be increased; and, if this be aided by the will and effort of the individual, muscular exercise may be considered to play some part in quickening and strengthening even the faculties of the mind, or at least their capabilities of sustained exertion; and, even without any effort on the part of the individual, the effect of muscular exercise on the physical condition of the brain, leads very notoriously to the removal of such mental gloom and despondency, as, in so large a proportion of the cases in which they

occur, are dependent on certain derangements of the physical condition of the brain—irregular distribution of blood, local congestion, or interrupted circulation from functional sluggishness,—and man may often be literally said to walk away from his cares, and secure, by the mere exercise of his limbs, bright and happy thoughts and feelings.

Muscular exercise is enabled to influence the circulation of the blood, and promote all its ulterior uses in the economy, not only by its direct effect on the arterial system, and the influence of the mechanical pressure of the contracting fibres on the contained and contiguous arterial capillaries, but, in some degree, likewise, by reason of the veins being to some considerable extent provided with valves, particularly those veins which have to carry the blood in a direction opposite to that of its gravity. The consequence of this is, that external pressure on these vessels assists in propelling the contents onwards,—the valves preventing their retrogression, as the *vis à tergo* does in the case of the arteries. The thoracic duct is, moreover, likewise furnished with these valves, at short distances; and thus, every movement of the trunk of the body, every full respiration, may be readily conceived to influence and promote the passage of the chyle through the lymphatic system, and cause it to be conveyed more quickly and readily to the current of the circulation.

The expenditure of azotised matter produced by all the processes of the animal economy, and the

large degree in which this is increased by muscular exercise, become important among the reasons for attention to this as a means of health, as a direct and powerful agent in carrying away effete matters from the system, and promoting the efficient compensation for the alimentation of the body.

The effect of muscular exercise on the great process of respiration, remains to be mentioned among its causes of powerful action on the economy. Perhaps, in consequence of the greater velocity, or the greater volume, in which exercise causes the blood to be driven through the tissue of the lungs,—stimulating, as this may be inferred to do, the nerves that minister to the purposes of respiration,—the respirations become, in a degree corresponding to the quickened or more energetic circulation of the blood, more quick and more deep; and the oxygenation of the blood is in the same ratio promoted, the consumption of carbon increased, and the animal heat maintained, and more thoroughly diffused through the distant parts, and to the surface of the body. The marked effect of muscular exercise in increasing the heart's action, either as to its quickness, or its power, or both, and in stimulating to more energetic action the muscles concerned in respiration, although perhaps mainly explicable on the principle of the more rapid return of blood to the heart, may likewise be partly referred to the general effect of increased capillary circulation on the whole of the fibrous tissues, and the consequent stimulus to all the moving apparatus, whether directly voluntary

or otherwise, to an increased exertion ; and to this probable influence, may be referred some of the good effects of exercise on the organs of secretion and excretion.

But muscular exercise is a direct source of pleasure to every one not suffering from diseased action. Every one must have felt this. The effect of using the muscles of voluntary motion, when all the processes of the economy are being justly and healthily performed, is to impart a marked and grateful stimulus to the sentient nerves of the part, and a corresponding and grateful stimulus to the nervous system generally, sufficiently noticeable by the mind when studious of its analysis, and always ministering indirectly to the happiness of the individual, colouring and brightening the thoughts and feelings. So much is this believed to be the case by some, that it has been asserted—a man may use his limbs too much to leave him in the enjoyment of his fullest capability of pure and abstract thought, and to the extent of making him unduly imaginative. Although this may well be matter of doubt, the fact and its wise and benevolent intention remain unaffected : that man derives an immediate pleasurable sensation from using his voluntary muscles, which not only gives to labour a zest, and even to monotonous movements some degree of enjoyment, but produces a re-action on the mind itself ; embellishing a life of virtuous toil with a degree of physical enjoyment, and mental energy, buoyancy, and hopeful light-heartedness, that can never be afforded in a like

degree to the drones—the mere “fruges consumere nati”—of the human hive.*

To be thus largely useful to the well-being of the economy, the exercise must not be confined to any set or series of muscular movements; but, as far as possible, should bring into play all the moving powers of the body. It may be said, in general terms, that the greater the number of muscles concerned in the exercise, and the more completely it

* “The first physicians by debauch were made;
Excess began, and sloth sustains the trade.

By chase our long-liv'd fathers earn'd their food;
Toil strung the nerves and purified the blood;
But we, their sons, a pamper'd race of men,
Are dwindled down to three-score years and ten.
Better to sweat in fields for health unbought,
Than fee the doctor for a nauseous draught.
The wise for cure on exercise depend,
God never made his work for man to mend.”

DRYDEN.

“There is a story in the Arabian Nights' Tales, of a king who had long languished under an ill habit of body, and had taken abundance of remedies to no purpose. At length, says the fable, a physician cured him by the following method: he took an hollow ball of wood, and filled it with several drugs; after which he closed it up so artificially that nothing appeared. He likewise took a mallet, and after having hollowed the handle, and that part which strikes the ball, he inclosed in them several drugs after the same manner as in the ball itself. He then ordered the sultan, who was his patient, to exercise himself early in the morning with these rightly prepared instruments, until such time as he should sweat: when, as the story goes, the virtue of the medicaments perspiring through the wood had so good an influence on the sultan's constitution, that they cured him of an indisposition which all the compositions he had taken inwardly had not been able to remove. This Eastern allegory is finely contrived to show how beneficial bodily labour is to health, and that exercise is the most effectual physic.”—*Spectator*, No. 195.

involves the full contraction of each muscle, the more influential will the exercise be.

The practical deductions from this remark are many. Riding on horseback is shewn to be a more important agent than being drawn in a carriage; walking to have more effect on the system than riding; quick walking than slow; running than either. A combination of several of these,—as each has its favourite sets of muscles, which it uses most,—is more influential than any one by itself. It follows, moreover, that exercise of the arms is only second in importance to that of the legs; and, consequently, that some simple gymnastics, such as raising the body from the ground by grasping a suspended cord, or a fixed transverse pole, with the hands,—or even swinging the arms round like the sails of a windmill,—or thrusting them backwards and forwards,—is an excellent auxiliary to walking exercise, or to running, and one which most men of sedentary habits ought to have recourse to, if all the purposes are to be fulfilled which exercise is capable of subserving in the economy.

What is called the hand-swing, or triangle, forms an excellent mode of exercise for the arms. It consists simply of two ropes, secured together at one end to a transverse beam of the ceiling of a room, or to a similar beam placed between the walls of the play-ground, the other extremities of the ropes being connected securely by a cross-bar of wood for the hands to grasp; the apparatus being fixed at such a height, that the bar of wood is only just within reach of the

raised hands, when the person stands on tip-toe. The exercise is, to swing by grasping the cross-bar with both hands. The apparatus may be removed and fixed again with much readiness, if the upper ends of the ropes, where they are fastened together, are securely attached to a strong iron ring, which may be fixed at pleasure to an equally strong hook, firmly screwed into the beam. The hand-swing not only furnishes a useful means of exercising the arms, but calls into action to a very efficient degree all the muscles of the back; and it is therefore adapted in an especial manner to the cases of most growing girls, in whom the spinal muscles so peculiarly require to be exercised and strengthened.

Dumb-bells, of a weight proportioned to the strength, are useful means of exercising the arms; giving an incentive to the exercise, and adding to its degree. Much harm has, however, been done, and dumb-bells have fallen into very unmerited disrepute, by having been used of too great a weight for the strength of the individual. Some may justifiably make use of them, when of the weight of ten, or even twelve pounds each; whereas a weight of two or three pounds each may be quite heavy enough for those who are weak, or who are quite unaccustomed to use them. In this latter case, the weight of the dumb-bells used may be slowly and gradually increased. But the risk of using them of too great a weight, and consequently overtasking the muscles made use of, perhaps straining them to an injurious degree, and possibly inducing some

degree of spinal irritation, with all its disturbing, and perhaps lingering and troublesome consequences,—independently of the risk of producing disorder in the lungs or the heart, by the interrupted respiration which violent muscular effort is apt to involve, or by the excessive stimulus of the heart's action which it sometimes proves to be,—should be borne ever in mind, as reasons for caution in the degree to which gymnastic exercises of any kind are allowed to be carried.

Hindostanee clubs form another and very admirable mode of exercising the arms. They are made of wood. Those from which I take the measurement are twenty-five inches long, three inches and a half in diameter at one end, and about one inch and a half at the other; the broad end being loaded with lead to any required degree. The clubs measured, weigh four pounds and three quarters each. It might be well to begin with using clubs of half this weight, and possibly of somewhat less length; and the weight and length might be increased according to the ascertained or augmenting power of the user. The exercise is—to stand perfectly erect, the feet close together, the shoulders thrown back, and with a club in each hand, grasped by the narrow extremity, to swing the clubs alternately over and around the back of the head, for fifty or a hundred times; this being probably repeated three or four times a day. This is an admirable means of exercise for the muscles of the upper part of the body; including, as it does, exercise of the muscles of the neck, chest,

back, shoulders, and arms. It seems to call more muscles into exercise than the use of the dumb-bells. These clubs, however, and dumb-bells, and most such means of adding to the artificial modes of exercise, are apt to do harm, and have no doubt in this way fallen into discredit, when the degree of the exercise and its duration are not adapted to the age and strength of the individual, and to the nature of the case. All violent exercises,—under which head, gymnastics of all kinds must be necessarily classed,—should be strictly forbidden, when there is even a suspicion of any organic disease, and must be attended with positive risk under circumstances of undoubted structural change in any of the great organs.

The skipping-rope, discarded, with her other toys, by the young girl when entering, perhaps prematurely, on her womanhood, might be justifiably continued as a valuable article in the boudoir of her earlier adult life. It is one of the best kinds of gymnastic exercise,—calling into action almost every muscle in the body.

There are few women who do not neglect exercise. Men have, for the most part, some necessary out-of-door occupation; and they almost universally walk more than women. Thousands upon thousands of Englishwomen never cross the thresholds of their houses oftener than once a week, and then it is probably to attend the public worship of their Maker; and it is seldom, that, in towns, the distance to the church or the chapel is such, as to occupy more than ten minutes in going thither. What is and must be the consequence of this? Breathing

ever, from week to week, and from year to year, the tempered, and perhaps ill-ventilated, and by so much mephitic, air of the dwelling,—never using so much muscular exercise, either in degree or duration, as quickens the heart's action by a single throb, or aids in any apparent and material degree the action of the extreme capillaries,—deriving no assistance from this most efficient of all the expending agents in effecting the detachment and removal of the effete matters of the system,—can we wonder that plethora, or that congestion, or that a languid circulation, or that a want of tone and vigour in the capillaries, or that defective assimilation of the alimentary supplies, or that deranged function and eventual disease, should be developed; favoured as such results are, by conditions of life and habits so foreign to those organic laws, in accordance with which the organisation was originally put together? Can we wonder at the dyspepsia, or the hysteria, the susceptibility to cold, the morbid sensibility of system, the sluggish organs, the favoured disposition to phthisis or to disease of the heart, the frequent derangement of the uterine functions, the possible barrenness of the married life, the abortions which so often enfeeble and disturb the system, and pave the way to so much evil; or that the children springing from so neglected a physique, should be feeble and sickly, either to be early freed from the miseries of a weakly and delicate existence, or (with difficulty reared) carrying the mischief through unborn generations, by producing in their turn an offspring with debility for their

inheritance. And debility, proving ever an initiative or strong predisposing cause of disease, may form the great means by which the predisposition to disease is justifiably said to become hereditary.

The extent to which the predisposition to different diseases is thus heritable, might have been expected *à priori*, or at least in some degree expected, by the remarkable extent to which physical characters are handed down from generation to generation. Thus, we see features, expression of countenance, complexion, tone of voice, capacity of chest, breadth of shoulders, gait, and gestures, transmitted from parents to children. A well-known and remarkable case of this kind occurred in Suffolk, in the course of the last century. A boy, fourteen years old, named Edward Lambert, born in that county, was exhibited to the Royal Society, in 1731. The skin is said to have been as though studded with warts of a dark brown colour, and cylindrical figure, some of them having an elevation of one inch, growing quite close to one another, and so stiff and elastic, that when the hand was drawn over them they made a rustling noise. In the *Philosophical Transactions* for 1755, there is a further account of the same individual, who had then six children, all having the same extraordinary condition of the skin as Lambert himself. In 1802, a description of one of these children, then an adult, was published, with engravings, by Tilesius; and in the year 1821, an individual of the third generation, lineally descended from Lambert, was exhibited in London, whose skin, on

the unquestionable authority of Dr. Bostock, exactly resembled the original description in the *Philosophical Transactions* and the plates of Tilesius. The case is known as that of the Porcupine Family. But this instance is only singular from the extraordinary character and degree of the diseased state. Not only the colour, but other structural and functional peculiarities of the skin, are likewise found to be derived from one or other of the parents; and a tendency to scurfiness, to eruptive conditions, to a dry or a very freely-acting skin, to a skin with a glistening and stretched look, or one that is wrinkled even in early life, are sufficiently noticeable among the physical peculiarities handed down from parent to child. Dr. Pritchard gives an amusing instance, in his *Researches into the Physical History of Man*, of the transmissibility of a peculiarity of feature from generation to generation. He says, "Dr. Gregory related to his numerous students, in order to convince them of the resemblance between children and parents, both with respect to external and internal structure, that, having been once called to a distant part of Scotland to visit a rich nobleman, he discovered in the configuration of his nose an exact resemblance to that of the Grand Chancellor of Scotland in the reign of Charles I., as represented in his portraits. On taking a walk through the village after dinner, the doctor recognised the same nose in several individuals among the country people; and the nobleman's steward, who accompanied him, informed him that all the persons he had seen were

descended from the illegitimate children of the Grand Chancellor." The thick lip of the Imperial Family of Austria is said to have been derived from the marriage of the Emperor Maximilian with Mary of Burgundy, and to be still visible in the family after the lapse of three centuries. The eye of our own royal stock of the Stuarts,—and it might be safely added, the prevailing features of their characters, mental as well as bodily,—affords another remarkable instance of the transmissibility of peculiarities from generation to generation. "In this way," says Dr. Gregory, in his "*Conspectus Medicinæ Theoreticæ*"—I have ventured to translate the passage—"parents often live after death in their offspring. Of a certainty, children are like their parents, not only as to features and the form of their bodies, but as to the disposition, as to the virtues and vices, of their minds. The imperious Claudian family long flourished in Rome; a family which produced the tearless Tiberius, the most fearful of tyrants; a family which gave birth to the inhuman Caligula, and to Claudius, and, after a lapse of six hundred years, to Nero." And Horace says, and says truly,—

"Fortes creantur fortibus et bonis :
Est in juvenis, est in equis patrum
Virtus : nec imbellem feroces
Progenerant aquilæ columbam."

CARMINUM, Lib. iv., Od. 4.

The degree to which the peculiarities are transmissible to the offspring, must be largely influenced by the amount of antagonism to them that may be

presented by those of the other parent. Hence may arise some part of the admitted great importance of avoiding successive intermarriages among the members of the same family ; adding, as this does, to the risk of the prevailing peculiarity becoming excessive, and leading to disease. The value of judicious intermarriages with unconnected families, in increasing the probable duration of families, their chances of healthiness and of distinction, can hardly be exaggerated. If all such care has been neglected, when care had been practicable, or where strong constitutional peculiarities had rendered care peculiarly necessary, the development of organic defects, of debile conditions, of disease, in the offspring,—either congenital, or arising afterwards from comparatively unimportant exciting causes,—occurs too often, to fail in proving the reality and importance of hereditary predisposition. And scrofula, in all its forms, may often be shown to be the direct result of disobedience to the organic laws, by intermarriages among the members of the same family ; or the infraction of these laws may equally lead to hereditary predisposition in the offspring, when it consists in the intemperance and debauchery of one or more generations, or where the circumstances of the parents' lives have been characterised by poverty, insufficient food, want of cleanliness, deficient exercise, or (its apparent opposite) extreme toil, or defective ventilation of the house, or miasmatic or other depressing influences of the locality, in which they have spent their lives. And mania, and its minor type, epilepsy,

—and gout, rheumatism, &c.,—serve to swell the catalogue of diseases, to which hereditary bias may give the tendency; a tendency easily acted upon, and readily converted into disease. The dwarfed condition of the existing aristocracy in one of the continental nations, has been often referred to, as one of the strongest illustrations of transmissible constitutional peculiarity, and the disadvantage of repeated intermarriages; and the strong national characters stamped on the Celt, the Saxon, the Gaul, the Greek, the Arab, the Tartar, and many *et-ceteras* of the families of the earth,—characters including the average height, the form of the features, the relative development of the cerebral, animal, and motor organs,—characters including the prevailing bias of the mind, and distinguishing peculiarities of creative effort,—are magnificent examples of the same great fact. Who can doubt the strong distinguishing characters of the Saxon race, who regards the position of England in the present day, with her steady rise among the nations of the world, and her people giving, from her small island-home, laws, influence, civilisation, enterprise, intellect, and Christianity, to a large share of the habitable globe?

The direct and practical bearings of these facts, and their importance to the existing and future races of mankind, may prove excuse enough for the foregoing observations on a subject, less immediately, as it might seem, relevant to the consideration of muscular exercise. But exercise, by strengthening the general system, thus comes to act, in an important

degree, not only upon the health of the body, and the probable expectation of life of the individual, but on the chances of a healthy and well-developed offspring. How important an element of what is called physical education, this view of the subject shows muscular exercise to be, is evident; how peculiarly important muscular exercise may be in the case of girls, is a reasonable inference!

This fact can hardly be too often or too strongly impressed on the minds of parents and teachers. It is not enough—it does not constitute the whole of their duty to the young and growing population—that they be carefully, steadily, and efficiently provided with food and clothing, and the comforts of life; it is not enough, that they have provided for them, the means of religious, moral, and intellectual enlightenment and progress,—and that these great *pabula mentis* are supplied in quantity and kind, suitable to the varying age and mental strength and growing capabilities; it is not enough, unless the means have been afforded of using the limbs and the trunk of the body extensively and sufficiently in muscular exercise,—and this done in such a way, as to secure the apportioning of such exercise, in degree and character, to the peculiarities and wants of the economy,—extensively using the different muscles, and calling them into a degree of exercise that is sufficiently energetic. Healthy manhood and womanhood cannot result from a childhood, that has not been permitted and encouraged to the exercise of the muscles, during at least one or two hours of every

day ; for, at all ages, health must be worked for ; and health and bodily exercise cannot be separated from one another. And such exercise must not be restricted to the quiet and partial muscular movements required in the act of walking ; although this is not to be neglected, inasmuch as change of air, exposure to the direct rays of the sun, and to an unbreathed and undeteriorated atmosphere, is necessary. But, in addition to this, such exercise must be made use of, as calls into action the muscles of the arms, shoulders, back, &c., as is the case in the games and sports of boyhood, or in the use of the skipping-rope, battle-door and shuttle-cock, and other less rough means of effecting the same end, had recourse to in the girl's play-ground or school-room. How often and strongly should it be said to all concerned in this great question—all the muscles of the body must be called into regular use, if muscular exercise is to be as useful to the health and well-being of the general system, as it is capable of being. At the same time, the importance of making this great means of health a sport and enjoyment, and by no means a task or a troublesome duty,—a relaxation of mind, and not a tedious addition to the scholastic forms and prescribed ordinances,—may be, in some instances, justifiably adverted to. Can anything be much more unreasonable, or less likely to fulfil its purpose, than to see the hours of play and of relaxation of mind, which might be passed in gleeful and active games, as cricket and the like, spent in making lads of unequal strength strive to accomplish the same violent

gymnastic efforts, with all the set and regulated formalities, and the same struggle for reward or distinction, and fear of disgrace, that animates the school hours? Can anything be less likely to form active and strong women in after-life, than the staid and frigid processions of boarding-school misses, that are encountered so often in the public streets?

A few words may be offered in this place, in favour of dancing, as an exercise, and as a school-room recreation. Exercising so many muscles otherwise little used,—exercising them fully and duly, and without violence,—exercising them to the cheering influence of music,—exercising them in forms of grace and beauty,—dancing may be made an important and valuable part of the physical education, and as such should be spoken of and promoted by the powerful voice of the medical public. The balanced action of the opposing muscles, the active use of the different articulations, the extensive and varied action of the spinal muscles, effected by dancing,—and the degree to which the mental excitement produced by it enables the exercise to be made use of without undue fatigue,—are strong reasons for so decided and favourable an opinion; and this, without obtrusive interference with opinions as to the propriety or otherwise of carrying the practice of dancing to an excess in the after-life, and making it the plea for late hours, &c. Let people think as they will of public balls, or even of private balls: with the conscientious opinions of others it is not my wish nor

intention to interfere: but to dancing in the school-room, or among the members of the family circle, few will object; and it is not too much to say, that, if dancing could be made a daily—not nightly—exercise, among the people of all classes, the healthiness and the expectation of life, as well as its happiness, would be increased.

The importance of exercising duly and regularly all the muscles of the body, cannot be too much or too strongly insisted on. It may be said emphatically, that workmen at laborious trades are generally unhealthy. This must, of course, in great part be attributed to the tainted and impure atmosphere, which they are still so often doomed to breathe; but there is no doubt that much of it is owing to the muscles being so very partially exercised. In most such trades, the muscles of the arms are almost exclusively made use of, those of the lower limbs being little exercised. The labour may be great, and even unduly fatiguing, but all the muscles are not adequately used; and even although a man may have to wield a hammer weighing twenty or thirty pounds during several hours of every day, that will probably not be sufficient for the requirements of the economy and the maintenance of health. For this, such other exercise must be used, as calls the lower limbs into action; and it may be needless to add, that, in order to correct, as far as may be, the effect of the impure or confined air of the workshop, such exercise should be taken in the open air.

It may be sometimes wisely remembered, that

exercise usually does most good, if the situation in which it is taken is elevated, and if the air is dry, and rather cold than warm. The sufficiently obvious explanations of this,—from a dry air containing a larger percentage of oxygen,—from its causing a larger combustion of carbon,—from its carrying off more readily the vapours exhaled from the lungs and skin,—from its stimulant effect on the vessels of the lining membrane of the air-passages, and on those of the skin,—are so many reasons, why this rule, although general, and as such useful, is not without many and important exceptions. Such an air would be manifestly objectionable in such cases as would be unduly stimulated by it; in such cases as could not resist the effect of the abstract dryness of air of an elevated district, or would suffer from the increased pulmonary effort involved in the extra consumption of carbon. Cases of general and great debility, from whatever cause, and many cases of phthisis, are among the evident illustrations of the conditions of system, in which an elevated district of country might be wisely objected to.

Of all kinds of exercise, walking is that which is the most universally attainable, and at the same time the best. Calling so many muscles into action, and especially those of the lower extremities, of which the circulation is apt to be more languidly and imperfectly performed, from the degree of resistance presented by the force of gravity to the return of the blood to the heart,—calling, moreover, so much of the moving apparatus of the body into reciprocal and

balanced action, flexor and extensor muscles being correspondingly exercised,—walking is undoubtedly the best of all exercises for the purposes of health; independently of its secondary and by no means little useful effect, of carrying the respiratory organs into the freer and purer air, and exposing the system to the extraordinary, and (at least in the colder and temperate countries of the earth) the healthful influence, of the direct rays of the sun.

The degree of the exercise must, of course, vary with the age, condition, and habits, of the individual; but the degree of exercise that is in most cases serviceable, is generally much underrated. Two miles a day is the *minimum* distance, which a person of moderate health and strength ought to walk. If the powers of the system increase, or are stronger to begin with, the minimum ought to be four miles. The object should be, in most cases, to walk the four miles in an hour; and the invalid, beginning perhaps by walking a mile, or a mile and a half, in an hour, might *gradually* increase his rate of walking, until he had accomplished this end. Quick walking calls more muscles into action than slow walking does, and is therefore better. The muscles of the back and trunk, neck and arms, are comparatively very little used in slow walking. A person can hardly walk quickly, without using them to a very considerable degree. It is a maxim so sound and important as to deserve frequent repetition, that the greater the number of the muscles used, the more advantageous will be the exercise.

The majority of people are wont to think too much of the other kinds of locomotive exercise,—as carriage-exercise, riding on horseback, and sailing,—and too little of walking.

Carriage-exercise is of passive, rather than active character ;—thanks to the perfection with which carriages are built, and the excellence of the springs on which they are hung, and the smoothness and hardness of our roads !—and is rather to be esteemed as a means of breathing the fresh and open air, than as a means of exercising the muscles of the body. The degree of exercise that is afforded by riding in a carriage, is indeed very trifling, and should never be relied on as a means of promoting the expenditure of the system.

The invalid just arisen from the bed of sickness, is usually re-introduced into the open air by carriage-exercise. This may not be improper if the carriage is a close one ; but if it is an open vehicle, it is almost invariably to be condemned. The action of the heart and arteries being enfeebled by disease, the blood is driven languidly through the system ; and the rapidly successive applications of cold air to the surface of the body, involved in the quick progress of the vehicle,—the system being, moreover, at the time, in a state almost that of absolute rest,—easily check the circulation of the blood through the vessels of the skin, by which the internal organs are apt to become unduly loaded with blood, congestion is risked, and a relapse into disease not unfrequently results. The degree of rapidity with which the air surrounding

the body is changed, necessarily and greatly ministers to this risk. The air immediately surrounding the body getting warmed, if the individual is stationary, protects him somewhat from the colder air which is exterior to it. The less frequently this outer garment is changed, the less heat is taken from the body.* The risk of the body being unduly chilled, is thus much less when the body is moved slowly through the air; and at the same time, in walking, no matter how gentle or how slow, some aid is afforded by the muscular contractions, to the weak and languidly-acting heart and blood-vessels, and risk from the chilling and depressing influence of the cold proportionably lessened. So firmly impressed am I with the importance of attention to this, that, if the strength is at all equal to it, I always advise my patients, when going out the first four or five times after an illness, to prefer gentle walking, even

* It may be needless to say, that this depends on one of the simplest of chemical laws. If a wet cloth is hung in dry air, the more dry the air, the more quickly will the cloth lose its moisture by evaporation. If a ball, heated, say to 600° , is exposed to the cooling influence of air at the temperature of 60° , it will at first cool very rapidly; but the nearer its temperature approaches to that of the air which surrounds it, the more slowly will it lose its heat. Its temperature will very rapidly fall from 600° to 300° ; less rapidly from 300° to 150° ; and, every succeeding degree, its rate of cooling will be still slower and slower. The more quickly the air around it is changed,—in other words, the colder the air which surrounds it, the greater the difference between its temperature and that of the air,—the more quickly does it cool. The drier the air around a wet substance, the more quickly will that substance lose its moisture; the more damp the air, the less readily does it acquire or imbibe moisture, and the more slowly will the substance dry.

if only a few yards, to any kind of less active exercise. Indeed, if the patient cannot walk thus much, and if the inability to do so is the effect of general debility, it may be well made a matter for thought and doubt as to the propriety of exposing the surface of the body to the open air at all. I may just mention here, although the remark would be better placed in a subsequent chapter, that, in the cases of such great debility, I have usually found much advantage in beginning with frictions of the surface, as with a flesh-brush,—at first gentle, and only used for a short time,—then, used more vigorously, and for a longer period; following this up, after it has been persevered in for a longer or shorter time, according to the nature of the case, by sponging the surface with warm water, of course continuing the friction; afterwards, gradually lowering the temperature of the water, and increasing the degree of the friction. By such means, in a time often very short, and to a degree almost incredible, and, if prudently managed, with scarcely any check or interruption, the patient has recovered strength, and been enabled to walk more and more strongly, and prepared for exposure to the natural temperature of the air without risk.

From what has now been said, another observation might be inferred; yet, perhaps, the mention of it may not be quite superfluous. The convalescent should never stand still when out of doors taking his exercise. It is a rule which should be impressed on the mind of every man just recovered from disease, on first committing his system to the ruder embraces

of the open air—he ought always to keep moving. I have known many a distressing case of relapse into disease produced by the kind sympathy of friends, meeting an invalid, and stopping to inquire after his health.

Riding on horseback, much less passive in its character than carriage-exercise, is an admirable auxiliary to walking, in the maintenance of health, and in securing the due expenditure of the system. It calls into action many muscles that are little used in walking, and is by so much subservient to the great purpose of exercising all the muscles. The peculiar movements of the body in riding, particularly the considerable use made of the abdominal muscles, has a marked stimulant effect on the functions of the viscera, and becomes often eminently useful in hepatic cases, and cases of sluggish action of the bowels. The remarkably good effect of horse-exercise, on the minor degrees and on the more chronic stage of muscular relaxation of the spinal column, evidently dependant on the gentle and equable use of important muscles of the back, which are otherwise little used, is generally known and fully admitted, and constitutes an important part of the treatment of such cases. It is impossible not to notice, moreover, in speaking of the advantages of horse-exercise, its exhilarating and diverting effect on the mind,—and the bracing effect on the vessels of the air passages and of the surface, of carrying the body so rapidly through the air; while undue depression of the circulation from this is prevented, by the degree

of muscular exercise involved in the necessary movements.

Sailing has long been lauded as an admirable remedy, in many, and especially in pulmonary, complaints; and its good effects have been attributed chiefly to the motion of the vessel. I have come, nolens volens, to a different conclusion. The air far out at sea is excessively pure, so far as being free from possible miasmatic matters; its temperature is remarkably uniform; its character is very peculiar, from being to such a degree charged with saline matters, and to the same degree with iodine, and probably other agents of equally powerful action on the human system; the mental excitement is very great, from the novelty of everything around the invalid,—the bustle and cheerfulness of everything and every one he sees; the necessarily regular hours for the meals; the early going to bed; the separation from perhaps desponding friends; the removal from the ordinary sources of care and anxiety; the escape from heated rooms, and an atmosphere that is mephitic in an at least corresponding degree; the consequences, at least probable, of getting rid completely of all congestive disturbance, by the sea-sickness; the stimulant action of the saline and iodised atmosphere, and the consequent activity of the absorbents,—when all conjoined, are surely enough to explain any and every change in the state of the invalid, the altered relations of all the processes of his system, and any resulting improvement in his health, without having recourse to the mere movement of the ship

as a means of accounting for them. It is probable, indeed, that the important action of a sea-voyage on the glandular system, and its beneficial effects on the many forms of scrofula, and even more particularly in pulmonary cases, is mainly due to the absorption of iodine from the sea air, and the steady introduction of this great agent into the system, in a form little likely to derange the organs of assimilation, or irritate the mucous passages. And, accordingly, a sea-voyage has prolonged many a life, and even brought back health and vigour to many a system, that had appeared beyond all reach of remedy, and out of the pale of earthly hope. It is a question for careful consideration and judgment, whether the general strength, or the local malady, may not have become so far impaired, or have attained so extreme a stage, as to render the chances of benefit less than the risk is great, of injury, and the aggravation of suffering, and the shortening of life, from the fatigues, and the primary derangements, of so great a change of life or circumstances as a sea-voyage involves.

There is one kind of exercise, that has not often been mentioned, nor even been thought of, as a means of expenditure and of health, as a means of giving tone to the parts made use of, and of diminishing the risk of their becoming enfeebled, and therefore by so much more prone to take on morbid action: I mean, exercise of the lungs and the muscles of the chest and windpipe, in speaking, singing, reading aloud, &c. Such exercise may, however, be

made a very important means of health, a considerable source of expenditure, and a valuable agent in developing and giving strength to structures of the first value to health, which are largely susceptible of morbid action, and the direct or indirect diseases of which constitute a fearful item in the mortality of most nations. "Whatever kind of employment or mode of life," says Dr. Carswell, in his valuable article on Tubercle, in the *Cyclopædia of Practical Medicine*, "necessitates or facilitates an active and ample display of the respiratory function, is generally admitted as a powerful means of preventing the occurrence of tubercular phthisis." After mentioning the fact, that children are much less often the victims of pulmonary consumption than adults, Dr. Carswell says, that he is disposed to attribute this "to the much greater activity of the lungs in children than in adults; we mean that kind of activity of these organs in children, which is the consequence of almost continued change of place and position of the body. Running, leaping, tumbling, wrestling, and the numerous little gesticulations, in which the upper extremities and muscles of the chest, shoulders, and neck, are called into play in every possible direction, and to the utmost of their extent, demand of necessity the most active co-operation of the lungs; thereby rendering the accumulation of the tuberculous matter in the air-cells and bronchi much less likely to take place in children than in adults, placed as the latter are, both by habit and

occupation, in opposite circumstances." This is a valuable opinion; but it will be observed, that I am arguing in behalf of a more direct use of the voice, as a means of expenditure and of strength to the system, and to the organs of respiration. One of the greatest things to be attended to in every kind of exercise, is to proportion it to the strength and the constitution of individuals. So proportioned, the exercise of the voice is no mean auxiliary to the exercise of the muscles concerned in the movements of the limbs; and, as has been said, may be fairly regarded as being a remarkably efficient means of giving additional strength to the respiratory organs, and of diminishing the risk of pulmonary disease. So important and so great do I consider this influence to be, that I think it would be well if it were made a prominent feature in the physical education of youth. It would be well, if children were encouraged in their vocal ebullitions of boisterous merriment. But I think it would be particularly well, if they were early exercised in the great art of reading aloud, not merely to the extent that may be at present practised in schools, but for longer periods of every day,—periods proportioned in length to the individual powers, and to the age,—and repeated at longer or shorter intervals, according to these circumstances,—and with the defined object of giving tone to the respiratory organs, and of adding to the development and capacity of the chest. It needs no pointing out, that this might be so managed, as to be in little or no degree looked upon

as an irksome task ; that the subjects selected for such exercise, might be as much varied in their character, and be as amusing, as might be necessary to relieve it from such a possible consequence. Were young people, in their days of childhood, allowed to laugh, shout, &c., at proper times, without restraint ; were they, in their days of girlhood or boyhood, made to read aloud, for such periods, and at such intervals of time, as could be done without undue expenditure, and perceptible fatigue,—not only would a good use be made of the precious hours of life's morning, in storing the mind with valuable matter, and strengthening it with soundest exercise, but the delicate tissue of the lungs would acquire a degree of firmness, the respiration an amount of freedom, and the voice a capacity, that would be a great means of averting the pulmonary complaints, with all their fatal consequences, that are so fearfully rife from the age of puberty upwards. In the later years of girlhood or boyhood, say from twelve years old upwards, prepared for it by such previous exercise, the lungs might with propriety be still further used, in singing, &c. ; while, without such preparation, this severer exercise of the respiratory organs is but too often followed by such marks of pulmonary derangement, as are only the harbingers of confirmed phthisis. In truth, accustomed to speak low as children, and but little used to reading aloud as girls and boys, the lungs are then often, for the first time, actively exercised ; and the result is, irritation and consequent inflammation of their substance or

their membranes, and the development of *latent tubercles*,—which might never have been formed, or never have been allowed to accumulate, had the exercise of the respiratory organs been efficient and regular from the earlier periods of life.

In the years of growth, the due development of the different parts of the body, a development to be mainly secured or aided by the exercise of the different parts, is the great object to be aimed at; the expenditure of the system is almost necessarily adequate to the ingesta; the additional supplies being used for the purposes of growth. But when the body and its several parts have attained their full size, and acquired the maturity of firmness and volume, the expenditure is no longer duly secured; and can only be so by regular and efficient exercise, which fulfils this valuable intention, in addition to that of promoting the power and healthiness of the part exercised,—provided the exercise be not greater than the structure can endure without undue exhaustion. Thus, however feeble the organs of respiration may be, and, consequently, however desirable additional tone might be as a means of health and longevity, the degree of the exercise must be apportioned to the degree of the local power, or it becomes hurtful instead of beneficial. And, however valuable as a means of expenditure to the system, exercise of the lungs, by speaking, reading aloud, or singing, might be, the usefulness, and even safety of this depends, of course, necessarily, on the power, and the development, and

the capability of enduring the exercise without injury, that those organs may possess.

Enough of this. The subject is, in my opinion, of the first importance. Medical men could hardly be more usefully occupied, than in the promotion of these means of aiding in the development, and adding to the vigour, of the pulmonary organs,—and in pointing out the exercise of the voice, as one of the ways, by which the due expenditure of the system might, in after life, be most usefully secured. And on the responsible watchfulness of the medical attendant, must rest the propriety of allowing this to be made a means of exercise in any degree, in the case of those who may be already invalided, and even of those who have a strong hereditary liability to pulmonary complaints.

I may be allowed to say a few words on the common practice of putting a flute, or other wind-instrument, into the hands of boys. I believe that, as a general rule, the practice is not judicious; and it is the less so, in proportion to the original delicacy of the boy's constitution, and in proportion as the several circumstances of his physical education have been neglected, or been unavailingly attended to. Every thing that has had, directly or indirectly, the effect of relaxing or weakening the powers of his body, must, of course, be a direct reason for not allowing him to exercise his lungs to any unusual extent, or in any unusual way. The time, and the earliest time, when such should begin to use them, and then only with much care and watchfulness, is

when the chest is fully formed, the body has attained its full growth, and the fibres and tissues have acquired the firmness of perfect manhood. Of course, the more that the lungs have been actively exercised in early life, the less, *cæteris paribus*, will be the risk of allowing young lads to play on wind-instruments.

How extraordinary these statements and notions read by the side of the well-known crudity, so boldly advanced in a certain work, that the exercise of the lungs, and dilatation of the air-cells, by blowing through tubes, may be capable of being a remedial measure in cases of existing tubercular degeneration of the pulmonary tissues! How strange, that such a doctrine should have been quoted without disapprobation, in a recent translation of a standard work on the diseases of the chest! How extreme exercise of a diseased and vital structure can be curative, or even safe, is more than reason can explain, or, I will venture to add, than experience can justify. It would be little less unreasonable, to prescribe a course of hill-climbing and violent gymnastics to a man with valvular disease of the heart, or of leaping and jumping to a sufferer from disease of the knee joint.

A neglect of apportioning the kind, and the degree of exercise, to the powers, and constitution, and other peculiarities of the individual's physical state, is probably the reason why the whole value of exercise, as a remedy for, and a preventive against disease, is so seldom derived, and perhaps so seldom apprehended

Is not exercise often enjoined, with so little reference to the patient's constitution, to his habits of life, and even sometimes to the nature of his complaints, that a certain daily mileage of walking, or the use of dumb-bells of undefined weight for an indefinite time, are the doubtfully useful, because the *ad libitum* prescriptions: the medicine being good, and adapted to the case, but the doses left to the chapter of accidents? * Such a proceeding is manifestly unreasonable, and must be injurious.

The character of people's minds differs so much, that the kind of exercise, to render the prescription palatable, and therefore give it all possible chance of being adopted and persevered in, must be adapted thereto. There are some, with minds of so grave and staid a character, that to recommend to such the skipping-rope, the battledore and shuttlecock, or any other of what are ordinarily used and thought of as playthings, might be construed by such persons into an insult, and would probably be treated with contempt; and most assuredly, the injunction would never be attended to by them; and yet these individuals might be induced to ride on horseback, or

* "That which is conducing to one man, in one case, the same is opposite to another. An ass and a mule went laden over a brook, the one with salt, the other with wool. The mule's pack was wet by chance, the salt melted, his burden the lighter, and he thereby much eased. He told the ass, who, thinking to speed as well, wet his pack likewise at the next water; but it was much the heavier, he quite tired. So one thing may be good and bad to several parties, upon divers occasions."—BURTON.

to use the Hindostanec clubs, or, in fact, to do anything else which would not, according to their ideas, seem to have anything childish or ridiculous attached to it. There are, on the other hand, persons of a different mental temperament, who could not be induced to take any kind of exercise, with sufficient regularity, or to a sufficient degree, that does not involve something playful to the mind's notions; something which their buoyant and laughter-loving minds can unrestrainedly enjoy; something which they cannot look upon in the light of a toil, or a necessity, but which carries along with it a reminiscence of their days of childhood, and, in fact, brings back the feelings that they then had. Such persons may even be induced to use a skipping-rope, and to play at battledore and shuttlecock, or to enter, with heart and soul, into a game at "catch me catch can." It need not be said, how important, and, indeed, needful, attention to this matter is, in prescribing different kinds of exercise.

The selection and adaptation of means of exercise within doors to different circumstances, is at once more important and more difficult, from the fact, that exercise is more apt to be neglected in wet and cold weather, and that the means of exercise within doors are more restricted. Those already mentioned, giving dancing a very honourable place among them,—and a nice quiet game, especially suited to girls, played with sticks and small hoops, called "Les Graces,"—and all the many games playable with a ball,—are the more important of these. Out of

doors, we have hoops and trap-ball for the younger, and cricket for children of maturer growth; besides many others, that will readily suggest themselves to the mind. Of course, none of these are ever to be thought of as substitutes for walking or riding. They do not afford the change of air, which is so importantly useful to health. But they are valuable auxiliaries to the mere locomotive exercises; and especially from involving some degree of running, and more active movements, with all the good effect of these on the healthy system, in adding to the general tone and promoting expenditure.

The age of individuals renders discrimination and modification necessary, as to the modes and degree of exercise that may be recommended. It would seldom be wise to advise the same kind of exercise to the elderly father or mother of a family, that might be recommended properly enough for his or her children or grand-children. The muscles cannot, in advanced life, be exercised so much or so long, as they could be safely used at an earlier period; nor can the organs so well bear, as they could have done in former years, the sudden and large influx of blood, that violent exercise necessarily causes. The walls of the blood-vessels are harder and denser, while their power of contracting upon their contents is materially diminished. There is, therefore, greater risk of inducing congestions of blood, and even hæmorrhage, than there is in young people, from the more violent exercises; and any such exercise may be highly improper and dangerous, and even

very active exercise be unsafe, under such circumstances; and more particularly, if the individual have been unused for many years to make such severe exertion. The boy or the girl may run, jump, leap, or undergo any such violent exercise, without any risk, unless where there is some evident local or general delicacy to act as a sufficient and sufficiently evident prohibition. The youth, trained to the habitual and free use of his muscles, can hardly suffer from any muscular exertion that he is capable of making. In such, the blood-vessels yield to a sudden influx of blood; they contract vigorously upon it, and drive it onwards; and the sole effect is a general quickening of the circulation, without local congestion in any organ or structure. This state of things commonly lasts for many years; but, towards middle life, the man is less fitted for this; he does it with more inconvenience, and his doing so is attended with more risk. He may be stronger than at any former period of his life; he may lift a greater weight with greater ease; he may be able to walk or ride further without fatigue, than he could ever have done previously; but this is not the question. He can endure fatigue better; his muscles are stronger and more firmly knit; but the several parts of his system have a less power of accommodation; they less readily adapt themselves to any sudden or great changes; a sudden and considerable rush of blood into any part, is less easily made room for, and less quickly got rid of; and, although such a man can take more exercise with less inconvenience, yet

violent exercise is attended with more risk. As years pass on, and the man gets older, this state of things increases; the blood-vessels yield less and less, their elasticieity diminishes more and more, and violent exercise is taken with greater and greater risk, until it becomes impossible, or, of necessity, dangerous.

The sex, too, is a matter that should be attended to, in estimating the kind and the degree of the exercise to be undergone. Girls and boys may be said to be nearly on a par until the age of ten or eleven years; but there is, even before that time, a difference between them; a difference as to strength and power. The boy will bear more exercise, and usually will bear more violent exercise, than the girl, without inconvenience. After the age of puberty, this difference becomes greater and more manifest. In general, young women, particularly if in a station of life where little or no personal exertion has been necessary, should not, without much caution, be allowed to take long-continued or violent exercise. It is evidently well, to begin by making the girl walk gradually more and more every day,—always keeping the degree to which this is carried, *within* the powers of the individual; then, to make her swing her arms to and fro, for a longer or shorter time; then, by degrees, to have this done longer at a time, and more rapidly; and then, and not till then, to allow a more active and violent kind of exercise. The already mentioned game, “Les Graces,” might be a gentle introduction to the latter; and afterwards the skipping-rope might be tried, and used at separate, and

at first short, intervals during the day. With boys, lads, and young men, less caution and preparation are in general necessary; but among them, such caution is required in the case of the delicate—those that have lax fibres and weakly constitutions. For such it is necessary, and perhaps for all it is well, to begin with a daily, systematic, and judicious degree of walking; adding to this, after a longer or shorter time, any simple exercise of the arms; and to this, the use of dumb-bells, climbing up a rope by the hands, or any other similar and active kind of muscular exertion.

The habits of the individual, and his or her usual employment, must be considered, in estimating the kind of exercise they should use, and the degree to which it ought to be carried. The more sedentary the occupation, the less varied and more uniform the habits, the more cautiously and gradually ought exercise to be made use of. I had lately (1835) two patients, one an engineer, the other a slater, both men of active habits, and both of them having had employments in which a good deal of muscular exertion was used habitually. For them both, exercise in the open air was a primary and essential ingredient in the treatment. I advised them to walk a great deal in the open air. One of them, to my astonishment, walked sixteen miles a day regularly without inconvenience; the other could walk twenty-four miles without feeling tired! How marked is the distinction between these men and a tailor or a shoemaker; who, seldom moving from his shop-

board or his last, and perhaps only removing thence to his lodging and his bed, finds every, however trifling, degree of exercise fatiguing, and cannot, without difficulty, walk more than a mile or two a day. This must be attended to in prescribing exercise, both as to its kind and its degree. But it should at the same time be remembered, as an aphorism to which the exceptions are few, that the more the exercise fatigues, the more necessary is its use.

The strength of the individual must, as has more than once been said, be constantly regarded with reference to the amount of exercise to be taken, and the degree to which it should be active or violent. If the kind and the degree of exercise be not proportioned to the individual's strength, it is worse than useless, for it does harm. If it be not sufficient, the individual had better, in general, not take it at all. The life of the strictly sedentary is, it is true, almost always shortened; but that life is often passed in moderate tranquillity of mind and body, until disease seizes on its victim, debilitated by his habits, and rapidly carries off its prey. But if the individual use a little, but an insufficient degree of exertion, a restless irritability of mind and body commonly makes its appearance, which embitters life more than pain, more than disease, and prepares the system to receive the inroads of the maladies to which it is predisposed. If the exercise be excessive, it debilitates instead of strengthening; it takes from, instead of adding to the powers; and is in itself a fertile predisponent to disease.

The degree of strength or power that exercise requires and exhausts, depends as much on its violence or activity as on its duration. The weak should walk at first slowly—move saunteringly along; gradually, as the strength improves, increasing the distance walked over, and the rate of motion.

Both the extent to which exercise should be carried, and its activity, must always be proportioned to, and kept within, the individual's powers, to be productive of real benefit to the health. Exercise should be daily carried to the confines of fatigue, but it should never produce absolute weariness.*

The degree to which the mind is occupied, has much to do with the amount of exercise that may be taken without fatigue; and, it may be added, has much to do with the amount of benefit that will be derived from it. Give an individual an object to walk for—to visit a patient, or a client, or a customer,—or to collect plants, or minerals, or insects,—or let him be accompanied by a cheerful and familiar friend,—and miles will be passed over almost insensibly, and a long walk taken probably with less sense of fatigue, than a short walk would have been under different circumstances. If people are so *unfortunate*, as to have no business or professional necessity, to make them take exercise in the open air, and furnish

* "Exercitationis autem plerumque finis esse debet sudor, aut certè lassitudo, quæ citra fatigationem sit: idque ipsum, modo minus, modo magis faciendum est. Ac ne his quidem, athletarum exemplo, vel certa esse lex, vel immodicus esse labor debet."—
CELSUS, lib. i., cap. 2.

the mental stimulus which would make the muscular effort easy to them, they might very wisely try to discover some such object that would not be unworthy of their native and acquired intellectual faculties and endowments. To many such people, some little attention to entomology, or botany, or mineralogy, or geology, might be doubly valuable; as the collection of specimens for the herbarium and the cabinet would supply the mental incentive to take the exercise which health demands, and the conjoining the mental and the bodily exercise would unquestionably much enhance the value of the latter.

A love of sport—shooting, hunting, coursing, &c.—is in this way highly useful to many, who, perhaps not accustomed to more intellectual pursuits, might hardly be induced by anything else to undergo active or laborious exercise. Yet with such an incentive, I have known an individual rise from his bed long before daybreak, and walk—perhaps beating furze-bushes half the time—with little intermission, during ten hours, and much of the distance over ploughed land; while a pound or two of dirt was adhering to his shoes, and each step must have been taken with more than twice the exertion that walking on a pavement, or on an ordinary foot-path, involves. The mental zest is indeed a great requisite, in rendering muscular exercise as useful to the system as it may be; and hence the sports of the field may be deserving of all praise, in cases where other

incentives to active out-of-door exercise are wanting. The great evil of these pursuits, as regards the question of health, is their being probably in most cases too severe, and their being so irregularly made use of. A man who leads a life that is otherwise perhaps essentially sedentary, during a few weeks of the year rides over so many miles of country, and at such a rapid pace, at the heels of a pack of hounds, as to exhaust the powers of himself and his horses, and this probably two, or at most three, days a week;—or he toils for a few days or weeks of the year on foot, in the pursuit of grouse, partridges, or pheasants;—or he seeks the banks of some rocky-bedded stream, with his rod and his flies, to spend hour after hour in practising the patient art of old Walton, but this only during a few weeks of the year;—and the rest of his time is spent as usual, perhaps ministering very insufficiently to the expenditure of the system, to the tone of the muscles, to the equalising of the circulation, by the use of his limbs. It is regular and moderate exercise, that health requires and demands of us. Habit may reconcile the system for a time, even to a life that is absolutely sedentary. But exercise, carried at one time much beyond the confines of fatigue, and to the probable degree of great physical exhaustion,—this being taken at long and uncertain intervals, which are probably characterised by little of laborious muscular effort,—cannot be supported on any principle of reasonableness, as regards the health of the economy; unless in so far

as it supplies the mental stimulus, so much required and so useful, in aiding the good effects of bodily exercise on the system.*

* The late Dr. Combe, whose death, at so comparatively early an age, will be most deplored, on public grounds, by those who are most familiar with his admirable writings,—in his work on “Physiology applied to Health and Education,” handles this subject with his usual ability. “In summer, walking excursions to the Highlands of Scotland are common among the youth of our cities, and when proportioned in extent to the constitution and previous habits of the individual, nothing can be more advantageous and delightful. But not a season passes in which health is not sacrificed and life lost by young men imprudently exceeding their natural powers, and undertaking journeys for which they are totally unfitted. It is no unusual thing for youths, still weak from rapid growth, and perhaps accustomed to the desk, to set out in high spirits at the rate of twenty-five or thirty miles a day, on a walking excursion, and (in consequence of carrying exercise, for days in succession, to the third degree, or that in which *waste exceeds nutrition*), to come home so much worn out and debilitated that they never recover. Young soldiers, when youth is scarcely finished, are well known to die in great numbers, when exposed to long and heavy marches, particularly when food is at the time scanty. Violent exercise is not less pernicious, and, as well remarked by Dr. Johnson, ‘it did great harm even when nations were more in a state of nature than they now are. Galen, in his discourse on Thrasibulus, inveighs against the athletic practices of the gymnasium. A smart walk of a mile is to a valetudinarian, what a grievous wrestle would be to an athlete. If we trace those dreadful aneurismal affections of the heart and arteries in early life, we shall find their origins in violent exercise or sudden over-exertion, in nine cases out of ten, when age and ossification are not concerned.’ Even a single day of excessive fatigue will sometimes suffice to interrupt growth and produce permanent bad health; and I know one instance of a strong young man, who brought on a severe illness and permanent debility, by sudden return to hard exercise for a single day, although for some years before he had been accustomed to every species of muscular exertion in running, leaping, and swimming. Many young men hurry on the premature development of consumption by excessive fatigue during the shooting season, in cases where, by prudent management, they might have escaped it for years, if not altogether. The

It need hardly be added, that, in the selection of any kind of exercise for those who are decidedly invalided, its adaptation, in kind and degree, to the nature of the complaint the patient is suffering from, should be especially attended to. It might seem to be evident enough, that when there is a much deranged or a diseased condition of any of the great organs, in the head, chest, or abdomen, any kind of violent exercise would be highly improper, and perhaps full of immediate risk;—that a disordered state of some of these organs admits of a nearer approach to violent exercise, than such a state of some of the other organs: for instance, that in many cases of disordered lungs, or liver, exercise on horseback is of the greatest use, and is perfectly safe; while in many cases of disease of the encephalon or of the heart, exercise of so active a kind would be attended with considerable danger, and these cases would probably be most benefited by quiet and gentle walking, or by riding in an easy and open carriage;—that, in spinal cases, of severe character and degree, on the other hand, any sitting or standing posture might be very injurious; and a vehicle long enough to enable the patient to lie down on principle already laid down, if not exceeding the point at which *exercise promotes nutrition and increases strength*, will serve as a safe guide on all occasions, and indicate the rate at which it may be extended. Old sportsmen know the rule by experience, and generally prepare themselves for the moors, by several weeks of previous training. The science and judgment which fox-hunters display in preparing their horses for their future exertions in coursing are well known, and might be still more usefully applied by their riders, to the training of their own families."

a mattress, with curtains, or glazed panels, that might be closed or opened at pleasure, so affording the invalid the benefit of exposure to the open air, and sufficient change of air, together with that of the perfectly passive exercise of the easy and rocking motion, might be the most suitable means of affording the needful exercise;—and, yet, although these matters are fully known and recognised, and many similar practical facts are scattered through medical works, and are matters of commonest observation, it is nevertheless quite true, that this question is much neglected in practice; and particulars as to the kind of exercise that should be made use of, and the extent to which it should be carried, if seldom asked for, are unquestionably as seldom entered into. It is quite certain that this should not be the case. Sir Benjamin Brodie, in some hints and suggestions as to the management and treatment of cases of distortion of the spine not connected with caries,* at once illustrates the importance of exercise as a remedial agent, and how much may be done by the exertion of his information and practised judgment on the part of the medical man, to guide and regulate the kind and degree of the exercise made use of. He says, “With a view to strengthen in particular the muscles of the back, particular exercises may be had recourse to; and many kinds of exercise have been contrived for this purpose. All climbing exercises are useful in this respect, bringing all the muscles of the spine into

* Vide *Lancet*, January 2, 1847.

vigorous action. They are at the same time beneficial in another way, the weight of the lower limbs tending to elongate and strengthen the column of the vertebræ. A rope with worsted wound round it, that it may not hurt the hands, may be suspended from the ceiling, and the patient will soon become a dexterous climber. There are often two or three girls in a family for whom this exercise will be beneficial; and that which would be a tedious and irksome task to a girl alone, will become an amusement when pursued in the company of others of her own age. The hand-swing affords a very useful exercise in these cases also. This is a triangle composed of a double rope, with a cross-bar of wood forming the base of the triangle, suspended from the ceiling at such a height, that the individual who uses it can just reach the cross-bar with her hands as she stands on tip-toe. She is to hold the bar with both her hands, and swing with her feet raised a little from the ground.* The effect of this exercise also is to bring the muscles of the spine into action, at the same time that the weight of the lower limbs operate in the same manner as when she climbs a rope. At first, probably, she will not be able to continue to use the hand-swing for more than a few seconds at a time; but as she grows stronger, she will swing for a much longer period. Another mode of exercising, and thus strengthening, the muscles of the back, is the following. Let one pulley be fixed to the ceiling,

* Vide supra, page 13.

and another to the floor. Let a small rope pass over the upper pulley, and under the lower pulley, a box containing a light weight being fastened to that end of the rope which is nearest to the upper pulley, and a handle to that which is nearest to the lower pulley. The patient, standing with her face towards the pulleys, is to raise and lower the weight, holding the handle in both her hands. The effort used in raising the weight necessarily calls the muscles of the back into action, and as the patient becomes accustomed to it, the required effort may be increased by putting an additional weight into the box. This exercise may be varied by taking off the handle, and fixing the rope to a bandage fastened round the head, so that the weight is raised by the action of the muscles of the neck and back, without the aid of the arms. The latter method of using the pulleys, however, is wearisome to the patient, and, practically, much less useful than the other. I offer these as examples of the kind of exercise which may be supposed to be especially adapted to cases in which there is deficiency of power in the muscles of the spine. Understanding what is required, you may easily invent others equally efficacious. Those which I have described have the advantage of simplicity, and of being easily adopted in a private house. One or the other may be had recourse to according to circumstances; and it is better that the patient should practise her exercises at different periods of the day, rather than be exhausted by practising them for a

very long time at any one period. Anything like over-exertion should be carefully avoided."

How different this, in sound principle, and in correct pathology, and treatment founded on physiology, from the older management, or rather mismanagement, of such cases as these, by steel supports resting on the pelvis, extending to the axillæ, and sometimes to the occiput, by which the straightness and strength of the spinal column were endeavoured to be restored, in defiance of the physiological law,—that muscles are powerful for their offices in the economy, in proportion to the health of the system generally, and to the degree of use which is made of them! How different is this, from the absurd contrivances, even now not discarded universally, by which it has been endeavoured to maintain or restore the straightness of the spinal column by attaching weights to the shoulders; or to secure an erect carriage, and drooping shoulders, and a flat back, by an apparatus with arm-holes, which fitted on to the shoulders, and was tightly laced between the scapulæ;—how different from another of the means that used to be so commonly had recourse to, of effecting these same intentions: putting a weight, which might be considerable or might be small, on the top of the head, which, according to circumstances, was to be worn and maintained in its place during a certain time of every day, or carried a longer or shorter distance,—the maintaining the head duly level being of course necessary, to prevent the

weight from falling ; the parties not considering, that the head might be kept duly level, and the weight maintained in its position, while the middle and lower part of the spinal column might be in a position as far as possible removed from a straight line ! But not only was this so far wrong and irrational : it involved the further absurd condition that the spine is a column without curves, whereas its curvatures forward and backwards are considerable in the cervical, the dorsal, and the lumbar regions ;—the crowning error of all being, however, that the extra pressure from above downwards, could only tend to increase any existing tendency to curvature, from general weakness of system, or from local debility or disease of the muscular ligaments or bones of the spinal column ! How different this, it may be added, to the injunction so often given by mothers and governesses, to sit quite straight, and to maintain this position during all the hours of the day, that are not considered to be stolen from the primary duties of acquiring education and the accomplishments, to be devoted to the routine walk for the so-considered secondary purposes of health. This said straight position has been, moreover, perseveringly and resolutely striven for, in no few cases, by making these victims of physiological ignorance and medical supineness, sit on benches of studious narrowness,—and, of course, without the excuse or opportunity of resting the spine against any support for the back. It has been but too often forgotten, at least practically forgotten, that the muscles of the spine are at least in passive

exercise,—both in antagonism to the corresponding muscles of the other side of the column, and in maintaining the body in the vertical position,—when the individual is sitting or standing, or otherwise than in the horizontal posture; and therefore that even long sitting, without enforcing the sitting in any constrained or painful position, may be an undue tax on those muscles, in the feeble,—and more especially during the years of growth or of development; that to minister to the healthiness of the general system, to promote the vigour of the muscular system generally, is essential to their being kept in a state of health and strength; and, moreover, that these muscles must not be unwisely used at the expense of the general vigour of the economy, or, sooner or later, not only will that vigour suffer, but the muscles which support the vertebral column will eventually become impaired, and spinal curvature necessarily follow. It must be added to this, to complete the truthfulness of the picture, and illustrate fully the amount of wrong done by ignorance to the physiques, and the chances of health and life, of the young and growing, that the mischief of keeping the spinal muscles in a state of forced and exhausting effort is necessarily and much increased, if, by position or otherwise, the use of one set of the muscles is enforced in an especial degree: a result manifestly consequent on protracted leaning to one side, or stooping over a table, desk, or work-frame; and that thus, the long and sedulous performance upon the harp or piano, the length of time devoted to writing, accounts, drawing,

mapping, stitching, "knitting, netting, and knotting," "crochet," or the embroidery frame, may be, by so much, laying up evils for the after-life, far greater than any personal or social advantage to be obtained by so much time, labour, and efforts, devoted to the acquisition of information, or the attainment of ever so high a degree of skill in such several accomplishments. Perhaps most of the good sought to be realised, without any of the evil, might be gained, by varying frequently the several duties, and consequently changing the position: not allowing more than perhaps half an hour at a time to be devoted to any one of the scholastic duties; but, above all, by seeing that these duties are proportioned to the physical powers of the pupil,—and that, at the same time, the means of health, by out-of-door and general exercise, are as much thought of, and as diligently studied and practised, as the development of the mind's powers and capabilities, or the securing the full development, and the educated and practised movements, of the muscles of the fingers.

That curious-looking machine, the chamber-horse, or invalid's horse: consisting of a seat, supported upon springs, by means of which, aided only by the exertions of the body and the arms, a certain degree of movement and exercise of the whole body is secured, often subserves a very useful purpose in the case of invalids, who are unable to leave the house, and to whom the use of their lower limbs may be, for many reasons, prohibited, or prove to be insufficient for the purposes of exercise. But it is probable,

after all, that more useful exercise of the different parts of the body, and exercise more easily adapted to the nature of the case and the powers of the patient, may be obtained by a due adjustment of weights of different degrees, and pulleys in different directions, than by any other means of exercise obtainable within doors. As mentioned in the quotation from Sir Benjamin Brodie's lecture, by means of a pulley of adequate size, securely screwed into a beam of the ceiling of the room—bed-room, dressing-room, school-room, play-room, or hall, or garden-house, as may be,—and another pulley screwed into the floor immediately beneath it,—and a strong rope of adjusted size, from the friction of which the hands may be sufficiently protected by thick gloves,—almost any variety or degree of exercise may be obtained: fastening a weight of properly considered size to the one end of the rope, and passing the rope over one or both pulleys, and over the upper or lower pulleys in the first instance, according to the direction of the force sought to be employed, and the sets of muscles especially required to be called into exercise. But medical men should feel, that to carry this out advantageously,—or even safely, in the case of the invalided,—their judgment and personal observation and watching are essentially needful. A sufficiently convenient arrangement is, to have two pulleys screwed into a beam of the ceiling of a room, three or four feet apart from one another, and corresponding pulleys screwed into the floor immediately beneath them. A rope,

to which a weight of desired size is securely fastened, is carried from the weight which lies on the floor over one of the pulleys screwed into the ceiling, and under the corresponding pulley screwed into the floor beneath it; the second weight of the same size is fastened to a similar rope, and this rope is passed over and under the two other pulleys; the party sits or stands in the space between the ropes and pairs of pulleys,—and either raises the weights by taking hold of the middle of the ropes and depressing the arms and trunk of the body,—or raises the weights by taking the end of the ropes after they have passed under the lower pulleys, and raising the bent body and depressed arms and shoulders. A useful exercise for those who are much crippled and almost confined to the chair, is to have a perfectly smooth and round log of wood, about two or three feet long, and from six to twelve inches in diameter,—to use this as a footstool, at any time,—but frequently to roll it backward and forward by moving the legs and feet. In cases of stiffness or contraction of the knees or ankles, this exercise will be found to be peculiarly useful.

The remarkable results of a system of training, deserve to be adduced in confirmation of the effects produced by muscular exercise on the animal economy. This system is called into requisition, when men, horses, dogs, &c., are required to make unusual exertions, and display the utmost activity, or the greatest strength, they are severally capable of. The effect of a prescribed and regulated diet, and of breathing a pure

mountain air, both of which are insisted upon as essential matters by all the authorities on the subject, need not be undervalued, because muscular exercise is considered to be the most important item in every system of training. Stipulating that the place selected for the training have a pure air,—and that it should be, when possible, in a mountain district,—the trainer enjoins, that his client should be fed, almost exclusively, upon animal food and stale bread. He is restricted to three nominal meals a day; but nearly all the day's nourishment is taken at the breakfast and the dinner. The breakfast, at eight o'clock, A. M., consists of beef or mutton, with stale bread or biscuit, and a restricted quantity of liquid. The dinner, at two o'clock, P. M., consists of steak, chops, roasted meat, or legs of fowls, and stale bread, with a little beer, or wine and water,—without spirits, on any pretence whatever. The use of supper at all is not recommended; but a biscuit and a little cold meat are allowed, if particularly wished for, at eight, P. M.,—two hours before going to bed. No meat is allowed but beef, mutton, or poultry; and the two former are more strongly advised. The meat must be roasted or boiled; and it is said to be desirable that it be made use of under-done. The person in the course of training must leave his bed at five o'clock in the morning, in the summer, and as soon as it is light in the winter; and he is then exercised, during three or four hours, in running, walking, leaping, riding, or in more than one of these ways. Between the breakfast and the dinner, he is again exercised, either in the same way, or in boxing,

ball-playing, or with dumb-bells, or in throwing the quoits. Again, after dinner, or between the dinner and bed-time, he has to walk, run, or ride; and always to the extent of inducing a marked degree of perspiration. In these ways, with this amount of steadily followed-up exercise, gradually commenced, and eventually carried to so great a degree,—with this highly nutritious diet, in which there is little or no stimulating drink allowed, and no recent vegetables, and no fat, and very little salt, and no article of food that is of difficult digestion,—and with the aid of free exposure, during so many hours of every day, to a fresh and pure air,—and with a limitation of seven hours for sleep, which is to be taken on a hard bed,—and with frequent frictions of the surface of the body, if required to remove the redundant perspiration,—the most astonishing results are found to be obtainable. In periods of from three weeks to as many months, men with flabby and tremulous limbs, who can undergo but little muscular exertion without extreme fatigue, whose skins are blotched and pimples from dissipation or irregular habits, who become giddy upon slight exertion, whose breathing becomes oppressed and difficult on their attempting to make any slight degree of unusual muscular effort, such men become, under such a disciplined system of training, ruddy in complexion, clear in their skins, with their limbs free from tremor, their muscles hard and firm, and capable of undergoing violent and long-continued exertions, without giddiness or any perceptible disturbance of the breathing. It is difficult

to over-estimate the importance of such results, or the proof they afford of the value and effects of muscular exercise, or the utility of turning such facts to a better account, than in preparing a jockey to mount and ride a horse over a given distance in the shortest possible space of time. It cannot be doubted, that a modification of the system of training might be often most usefully directed in many cases of deranged health, with the strongest probability of great and durable advantage; and the facts are, therefore, well worthy of attentive consideration.

In conclusion, as regards muscular exercise, I would add, that the healthiness of the mental powers,—their capability of high and noble aspirations,—their aptness for deep thought or improving study,—depends so much on the health of the body, on the regular discharge of its every function, as to form in itself, perhaps, the strongest motive for giving attention to the means by which such a condition of the bodily functions may be maintained or restored:—

*“Corpus enim male si valeat, parere nequibit
Præceptis animi, magna et preclara jubentis.”*

As there is no means of effecting this, of such universal applicability, or so uniformly efficacious, as bodily exercise,—so ought bodily exercise to be cultivated, if for this reason only, by every one who thinks that all things should be made subservient to the mind's improvement.

By way of summary, it may be said that exercise is servicable, in proportion to the number of muscles

which are called into action by it; in proportion to the degree to which each muscle is contracted; in proportion to the duration of the exercise; in proportion to the purity, the dryness, and the suitable temperature, of the air which is breathed at the time of taking the exercise; in proportion to the nervous and vascular powers being otherwise unexhausted or unengrossed, and therefore the exercise being taken neither immediately before nor soon after a meal; and in proportion to the regularity with which the exercise is made use of.

CHAPTER IV.

On Ventilation, Climate, and Change of Air.—Ventilation.—Constituents of Atmospheric Air.—Respiration.—Animal Heat.—Effects of Respiration on the Blood.—Sanatory and Morbific Effects of Respiration.—Sanatory Effects of Drainage, &c.—Street-Ventilation.—Intra-mural Sepulture.—Ventilation of Dwelling-Houses.—Ventilation of Rooms.—Relative Mortality of Town and Country.—Sanatory Improvement of Towns.—Mr. Farr, on the Health of Towns.—Degree of Ventilation Required.—Effect of Ventilation on Health.—Reference to Parliamentary Inquiries.—Effect of Ventilation on Life-Expectancy.—Effect of Ventilation on Disease.—Dr. Reid, on the Degree of Ventilation.—Ventilation of Public Buildings.—Some Effects of Deficient Ventilation.—Facts and Arguments about Ventilation.—Combustion a Cause of Atmospheric Deterioration, and the Practical Inferences.—Effects of Heated Rooms.—Strictures on the Use of Gas as the means of Illumination in Apartments.—Situation of the Bed-Room to be preferred.—Temperature of Apartments.—Climate.—Effect of Climate on the Duration of Human Life.—Effect of Elevation on Climate.—Effect of the Ocean on Climate.—Climate affected by Hills and Valleys, by Seasons, by Vegetation and Drainage, &c.—The Climates of different Localities : their Therapeutical Effects.—Change of Air : its important Influence on the System.—Hygienic Effect of Travelling.

VENTILATION, climate, and change of air, important as is their investigation in an inquiry into the physical conditions necessary to health, may be included without disadvantage under the same section,—embraced as they are in the comprehensive question of the effects of the atmosphere on the animal system,

the physiological effects produced by it on the blood, its influence in the production of the animal heat, its effect in carrying off a large quantity of carbon from the body, and the influence which interference with these great processes on the one hand, or their promotion on the other, exercises on the health of man, on his expectation of life, and on the causes and prevention or removal of disease.

The importance of ventilation,—of a sufficiently frequent change of the air of our towns and our dwellings, to preserve it in an adequately pure state for the purposes of life, and the maintenance of health, and the prevention of disease,—is probably second to that of no single subject included in the general elements of hygiene; and it is as true, that no subject has been proved to have been so little attended to, and that on so single question has neglect been followed by such marked and injurious consequences to the physical well-being, and indirectly to the moral well-being, of the human race.

Atmospheric air consists of oxygen and nitrogen. These elementary gases are not, in all probability, in a state of chemical combination, but are simply mixed together. The probable uses of this simple mixture of these gases, in promoting the rapid and sanatory diffusion of any excess of either gas, or of any foreign gaseous substance, throughout the atmosphere, without reference to rarity, or density, or temperature, deserve to be noticed. There is, besides the oxygen and hydrogen, a small proportion of carbonic acid, always present in atmospheric air,

computed to amount to but $\frac{1}{1000}$ th part by weight. This proportion of carbonic acid is due to the mutual action and relation of animal and vegetable life ; the animal organism throwing off carbonic acid, and the vegetable organism consuming it ; their antagonistic influence maintaining the proportion of carbonic acid at the same point ; and the rapid diffusion of uncombined and mixed gases, causing the air that travels over large tracts of uninhabited country, covered with a dense and gigantic vegetation, to be inappreciably different from the air that has passed over a fully peopled district. It should be added, although it seems to be of no practical importance, that the air of the atmosphere appears to contain a uniform proportion of ammonia : this proportion is even less than that of the carbonic acid. The chemical properties of the air are chiefly those of the oxygen which it contains, so far diluted by four times its bulk of nitrogen : that is, one hundred volumes of the air contain eighty parts of nitrogen and twenty parts of oxygen. By weight, the proportions are nearly two equivalents of nitrogen to one equivalent of oxygen. The air is a supporter of combustion and of respiration by virtue of the oxygen it contains ; in both these important processes converting carbon into carbonic acid, with the attendant effect of a proportionate elevation of temperature. The effect of the nitrogen as to combustion and respiration, seems to be merely the dilution of the oxygen, and to diminish accordingly the rapidity of these great processes. The elasticity of the air ; its density—100 cubic inches

weighing about 31 grains; its general pressure on the surface of the earth—a column of air with a base equal to a square inch, and of the whole weight of the atmosphere, weighing 14lbs., and pressing on the surface to that amount; the diminution of the density of the air in the more elevated parts of earth surface,—and the effect of this on its character and influences—are some of the more prominent of the physical characters, uses, and effects of the atmospheric air.

In respiration, the air inspired, consisting, as has been said, of two equivalents of nitrogen and one equivalent of oxygen, undergoes a great and important change. A larger or smaller proportion of the oxygen disappears, and is replaced usually by an equal volume of carbonic acid, which is expired along with the unaltered nitrogen, and a considerable quantity of watery vapour. The effect of this upon the condition of the circulating blood is very great. The dark-coloured venous blood, returned from the system to the lungs, undergoes a great change: its colour is brightened; its globules have absorbed the oxygen of the inspired air, and parted with the carbonic acid they had been previously charged with, which has been removed from the economy by the act of respiration. The absorption of the oxygen by means of the globules, gives to arterial blood its florid colour, which it may be made to lose artificially, out of the body, by the action of carbonic acid; and this may be again separated from the blood, and its bright colour restored, by the action of oxygen, which is

likewise attended, as in the lungs, with the separation of the carbonic acid. It seems to be ascertained that this remarkable property of absorbing oxygen possessed by the blood, is due to its globular constitution; and it is probable that the absorbent power of the blood-globules for oxygen, is owing to the presence of a certain proportion of iron, which becomes thus more or less oxydised. As carbonic acid appears to contain its own volume of oxygen, the fact that the proportion of carbonic acid evolved is exactly equal in volume to that of the oxygen absorbed, seems to admit of being readily explained. The globules of the blood, thus conveying oxygen through the arterial system to all the parts of the animal economy, yield it up, in passing through the capillary vessels, to certain of the bodily constituents. In the case of certain of the fully organised particles, this expenditure may determine their separation from the living structure, and solution in the blood, preparatory to their removal from the system; in the case of recently organised alimentary matters not yet developed into vital tissue, it may interfere with this further development, and make immediate use of them, for the consumption of the oxygen and consequent evolution of temperature, or for the ulterior purpose of using the oxydised compound in some of the processes of secretion. However obtained, the oxygen of the arterial globules finds carbon on which to act, either in the blood itself, or in the tissues it permeates, and thus promotes the expenditure of effete matters that are no longer wanted in

the economy, aids in the great immediate or secondary purposes of secretion, and maintains the body at the elevated temperature which is essential to life.

A temperature that is more or less elevated above that of the surrounding atmosphere, seems to be essential to life in all animals. In birds, the temperature is higher than in any other class of animals. According to Tiedemann, the temperature of birds ranges from 100° to upwards of 111 degrees. In the mammalia, on the same authority, it is from 97° or 98° in the horse, to 104° in the sheep, and 105° or 106° in the bat. In the cetacea, the temperature is much the same as in the other mammalia,—ranging in the different species from between 95° and 96° in the porpoise, to 104° in the Greenland whale. The temperature of the amphibia does not differ so much from that of the surrounding medium, being from 4° to 10° higher than that of the medium lived in,—the temperature of the animals being greater in warmer than in colder air. Even in what are peculiarly considered to be cold-blooded animals, as fishes, the animal temperature seems to be from 3° to 7° above that of the surrounding water.

The temperature of the animal system appears to be intimately connected with the number of the blood-corpuscles, as well as with the rapidity of the circulation, although more closely with the latter than with the former. Whether the theory of Baron Liebig, that the elevated temperature of the animal system depends upon the corpuscles of the blood conveying the oxygen to the capillaries, by means of the

conversion of the iron they contain into the state of peroxyde,—or that of M. Mulder, that this absorption of oxygen depends on the oxydation of the protein compounds introduced into the system by the processes of nutrition,—be or be not the correct explanation of the great fact, can signify very little, further than to show the difficulty and intricacy besetting such questions as these. It is enough to have it admitted, that oxygen is absorbed by the blood in its passage through the lungs,—that it is conveyed to the capillary vessels of the different parts of the body,—that there it acts upon the compounds of carbon,—that in consequence of their combination, heat is evolved, and at all the different parts of the body,—and that the carbonic acid thus formed, is conveyed to the lungs, and disengaged by expiration, unless what may have escaped, combined or uncombined, in the different excretions, or by the various means of egress afforded to it through the tissues of the body.

The effect of the nitrogen in the atmospheric air, appears then to be simply negative; acting as a diluent to the oxygen, and diminishing its power as a disintegrant and stimulant to the system. As has been said, moreover, the change effected in the blood by the respiratory process, appears to be almost entirely confined to the corpuscles. The respiration is effected in man and the mammalia, by the dilatation and contraction of the cavity of the thorax. The capacity of the chest being enlarged by the flattening of the diaphragm and elevation of the ribs, the air

rushes in to restore the atmospheric equilibrium,—the volume of the lungs is by so much enlarged,—and the air is freely distributed throughout the pulmonary parenchyma, by the countless and minute ramifications of the air-tubes, which terminate in minute vesicular dilatations, the walls of which are covered with a capillary net-work of blood-vessels. It has been calculated, that the whole internal surface of this membrane, through which the air and the blood are thus brought into such extensive and intimate relation, amounts to 1400 square feet,—that the lungs contain, after the strongest expiration 35 cubic inches of air, after an ordinary expiration 108 cubic inches, and after a very full inspiration 240 cubic inches,—that the amount of air changed at every respiration, amounts to from 10 to 13 cubic inches, being probably the half, are rather more than the half, of the whole of the air admitted at every inspiration, which is calculated to be, according to individual stature, from 15 to 25 cubic inches,—that the quantity of air respired in the 24 hours, may be from 400,000 to 500,000 cubic inches,—that women expire less carbonic acid than men,—that the quantity of carbonic acid expired, is greater in proportion to the greater vigour of the system, unless under some peculiar circumstances of diseased action,—that it increases with age to the 40th or 45th year, and then diminishes,—that the quantity of carbon expired is diminished by hunger and rest, and increased by the opposite conditions,—and that it is greater in the day than in the night. The quantity

of carbon expired is variously stated by different experimenters, but may probably be about 150 grains per hour,—allowing for variations in the same individual at different times, and, in different individuals, for age, size, and other circumstances.

The inspired air is first warmed, then saturated with moisture, then exposed to the large surface of the moistened air-cells at the extremities of the air-tubes. The nitrogen of the inspired air remaining essentially unchanged,—the oxygen being to some extent exchanged for carbonic acid, as it would seem by a simple membranous diffusion,—the blood corpuscles absorb the oxygen; and as by its means, in the course of its circulation through the system, carbon becomes converted into carbonic acid, the blood at length returns to the lungs surcharged with this compound of carbon and oxygen. The moistened membrane of the air-cells offers little or no impediment to the action of the air on the blood: the permeability of membrane is well known; gases are found to permeate even dead membrane with considerable readiness; and blood is said to be susceptible to atmospheric influences, even when removed from the system, and enclosed in a moistened bladder.

The expired air contains a considerable proportion of watery vapour, which may possibly be formed during the more perfect organisation of the alimentary atoms, which may be attended with the disengagement of a definite proportion of the component water. Or it may be, in whole or in part, a consequence of

the exposure of so large a surface of moistened membrane to the action of the air. The quantity of water thus conveyed out of the system is too variously estimated by different experimenters, to afford any satisfactory conclusion respecting it. The lowest calculation gives it at nearly 3000 grains of water in the 24 hours.

All these facts only serve to show how important a share in the economy of the system, is performed by the process of respiration,—how vast must be the influence thus exerted, on the life and well-being of mankind,—and how important an agent the respiration may be, in conducing to the health, or in undermining the powers and shortening the duration of the vital processes. And, accordingly, not only is it quite true, that diseases of the lungs constitute a large proportion of the general mortality, but it is likewise true that, by breathing tainted air, by accidental, or occasional, or habitual exposure to an impure atmosphere,—as evidenced in the important class of diseases admitted to be infectious, and in the immediate influence frequently consequent on exposure to concentrated and noxious effluvia, or in the eventual consequence of breathing an atmosphere characterised by the modified impurity caused by a concentrated population, or defective ventilation, drainage, or sewerage,—a far larger number of people are prematurely destroyed, a far larger number of years are subtracted from the just duration of human life, than can be laid to the charge of all the vice, immorality, and several wrongs to the

individual organisations, that affect the life, degrade the physical strength and character, or derange the physical usefulness, of the human race.

On this view of this question, the subjects of drainage and sewerage rise into a degree of sanatory importance, which is greater than could have been readily preconceived, and which I believe can hardly be exaggerated. This importance, which may be less appreciable in degree when a dwelling-house is detached, and remote from other habitations, must rise immensely in extent and character when several houses come to be placed side by side, and still more when acres or miles are covered, and perhaps thickly covered, with densely-peopled dwellings. How far this has been attended to or otherwise, Parliamentary Reports have of late years only too fully demonstrated; and the fact that by these means the attention of the public has been in some degree aroused, and some few steps taken in different towns and districts in the right direction, for the removal of such abuses of the life-probability and health of the people, has only served to show how much remains to be done, and how difficult it is to move people to put themselves to temporary inconvenience, or to undergo any considerable amount of expense, or to subject themselves to the necessity of some immediate exertion, when the question is not one that immediately and sensibly affects the individuals, and does not interfere at once with the appliances and means of existence. What can be said to the facts, that one half of the mortality of England is directly

referable to discases of the respiratory organs; and that the half of the remaining mortality, or, in round numbers, one fourth of the whole, is referable to epidemic, endemic, and contagious diseases, which are so intimately connected with the condition of the atmosphere; the remaining fourth of the whole mortality having to be divided among the diseases of the brain and the nervous system, and the diseases of the digestive organs,—numbers of which would no doubt owe their predisposing causes, to the disturbed and cachectic condition induced by a continued respiration of a vitiated atmosphere? Let the reader refer to the several Sanatory Reports that have been issued by the authority of Parliament within the last few years, including the Reports of the Registrar-General,—let him study the startling tables of diseases and their mortality contained in those reports,—and then trace so many of those diseases, as he will find himself compelled to do, with all their sad consequences in the diminished expectancy of life, in the deaths of the middle-aged, and consequent reduction of the growing and the helpless to orphanage and poverty, to the neglect of drainage and of sewerage, to imperfect ventilation of streets and dwellings,—and see how fever may be mapped as to the streets and districts attacked, by the imperfect condition of the sewers,—and see how the mortality of towns over that of the rural districts is needlessly and wantonly increased,—and see how, even in rural districts, fever is engendered and continued by the putrid emanations from neglected and uncovered

ordure, and needless collections of stagnant waters charged with animal and vegetable decomposition,—and thus see, how a village, or a parish, may become as remarkable for the amount and character of its mortality, as the unventilated gaols used to be in the last and preceding centuries,—and then try to think how important must be the condition of the respiratory organs, and how important must be the purity of the respired air, to the health and life-expectancy of the population !

Supposing the primary conditions of drainage and sewerage to be secured, and to be in a state of fullest efficiency,—and this would very soon be the case if medical men would but bestir themselves to draw public attention to these questions, to their fearful and perhaps incalculable importance, and supposing that every householder were at once bent on exerting his social power in securing these great essentials to his chances of health and life and those of his children,—and to use his individual power by removing to a well-sewered and drained district, no matter at what immediate pecuniary risk or sacrifice, under the conviction that the alternative is a fearful probability,—the next great question becomes that of a thorough street-ventilation, to be secured by having the streets as wide, as a needful economy of space and previously existing circumstances will admit, by having the roadways and footpaths as clear as may be, by having the roadways sufficiently arched, guttered, and drained by gratings, and the footpaths so inclined as to prevent the formation of puddles and the

lodgment of impurities. Thus, the question would be reduced to that of house-ventilation ; a matter little less neglected than the more widely spreading evils already spoken of, and one that is only of importance second to them.

There is, indeed, one question that should be referred to, in this sketch of the comprehensive question of the causes and effects of a vitiated atmosphere on the economy of health, viz., the deleterious influence of the interment of the dead in crowded churchyards, that are surrounded by the abodes of the living : a practice which, however it may harmonise with the feelings, from long-continued custom, is quite indefensible, and not justifiable on any pretext whatever. By circumstances that are perhaps characteristic of this country, this great sanatory question has been kept in abeyance, and subjected to some degree of sufficiently important prejudice. By having become mixed up with sectarian feelings, with attempts to remove the performance of the last duties and offices of the dead from the controul of the clergy of the Established Church, by the opening of unconsecrated grounds for the purpose of interments ; the prejudiced feeling being added to by the circumstance, that these cemeteries have been formed with the capital of public companies, subscribed with the avowed object of realising a profit on such investment ; a strong and not altogether unreasonable degree of feeling has arisen in the mind of many, in favour of intra-mural sepulture. But the great sanatory object must be sooner or later

obtained without any attendant evil; the living and the useful members of the world's family cannot be suffered to continue, year after year, damaged in health, and curtailed in duration of life, for the purpose of enabling the dead to be interred in any particular place, no matter in what degree sanctioned by usage or by feeling. The whole good sought for may be attained, by the due consecration of ground, the property of the public, in places sufficiently far removed from human habitations, or from a densely peopled district, to do away with evil results to the public health; and this, with the fullest sanction and guidance of the constituted ecclesiastical authorities, and every reverential respect and attention that is at present shewn to the remains of the departed. It might be said, with much more real respect to those remains, if only one-half of the statements and evidence brought forward by Mr. Walker, in his great and untiring efforts in this important sanatory cause, were shewn to be true;—if, in the crowded churchyards, and in the towns almost all the churchyards are crowded, the corpses are only covered over with a thin layer of earth, as a pretext for interment; to be torn, within a few months or years, from their receptacles, mangled and cut to pieces, and thus made to occupy the least possible space; the coffins being destroyed, and the coffin-furniture sold for the value of the metal;—while the injury done to the health of the neighbouring population from the emanations of the graveyards,—an injury sufficiently shewn and proved

by Mr. Chadwick's able report,—might be wholly arrested.

As regards the general ventilation of dwelling-houses,—how little the sanatory importance of the subject has been understood, and how great the indifference respecting it, are proved by facts as striking, as those which appertain to the more wide questions of drainage and sewerage. Look at the numbers of people who are living in cellars, in some of the greatest and wealthiest towns;—look at the facts as to the crowding of such cellars with inmates: places that must be imperfectly lighted, if lighted at all, by the sun; that must be imperfectly ventilated, even if a partial current of air through them be established from the door to the fire-place; that must be damp and noisome from unavoidable circumstances, independently of the polluted atmosphere, breathed over and over again by their wretched inmates;—carry the mind upward to the rooms, crowded and close, of a class next above that of the occupants of cellars, and find the numbers who occupy the same small room;—and thence go to the crowded workshops, reeking with the mingled results of imperfect ventilation, or if not so far neglected, marked by a distinct sense of closeness and mal-odorous character;—and thence proceed to the over-heated and over-crowded apartments of warehouses and factories;—and thence, ascending still in the social scale, follow the member of the middle classes to his close apartment, to his bed-room, probably with a low ceiling, with closely

fitting windows, with a small fire-place, probably robbed of all its ventilating advantages by what is called a fire-board being tightly fitted into it, or by a sack full of straw being stuffed up the chimney that is guiltless of a fire ; the room being crammed with furniture, and made comfortable (?) with much of woollen fabrics, as carpets, curtains, &c., which serve as reservoirs for the dampness of the air, whether derived from his own pulmonary and cutaneous exhalations, or simply from the humidity of the climate or the season ;—and thence gather how little ventilation is understood, or how little of practical good any knowledge of its principles has thus far contributed. And this may be carried upward, as far as larger dwellings, and wider streets or spacious squares enable it to be thus extended, to the houses of the wealthy ; and the degree to which the free ventilation of houses and rooms is neglected, be found to afford grounds enough for animadversion,—and especially as regards the dormitory, the ventilation of which, shut up as man is in it for so many hours of the twenty-four, is necessarily more important than the ventilation of the sitting-rooms.

The rapidity with which the air of a room becomes vitiated, unless due ventilation is secured, is easily calculated, by knowing that 16 cubic inches of air are deteriorated, on the average, by every respiration, and that about 20 such respirations are taken in the minute ; rendering the quantity of air that is to all intents damaged for the uses of the economy in the

minute and the hour, a matter of simple calculation. Even in this view, the effect of confining a single individual in a carefully shut up apartment of small dimensions, during many successive hours, is obvious enough. But to this must be added, the effect of the large quantity of watery vapour exhaled from the lungs, which is sufficiently demonstrated in cold weather by the condensation on the bed-room windows; and still farther evidenced by the dampness of woollen articles of furniture or clothing, which have remained all night in a closely shut up and occupied bed-room. Nor is this all: the secretions from the skin must form part of the account; and not only as regards the amount of aqueous matter thus excreted, but as regards the other more directly injurious matters, by which, in an imperfectly ventilated room, the air becomes perceptibly tainted, and by which every building that is occupied by large numbers of people, however carefully ventilated, becomes perceptibly offensive to an olfactory apparatus that has not been blunted by usage, and is to some extent injurious to the health of the occupants, and found to be so by the registration reports.

It is indeed impossible to learn, that the deaths from a given population, referred to the heads of epidemic, endemic, and contagious diseases, are almost double, and in some years more than double, in city districts, than in rural districts,—that, in the case of sporadic diseases, the excess of mortality in the town population over that of the country population, is in nearly the same fearful ratio,—without becoming

fully alive to the importance of the great fact, that man's health suffers much from the vitiation of the atmosphere caused by a crowded population. The number of inhabitants in England and Wales to every square mile of surface, has been calculated to be about 265. In the strictly rural districts, the population must be much more thinly scattered than this, inasmuch as the accumulation of people in towns and cities is so very great,—amounting in some of the more densely peopled districts of London, to more than 186,000 inhabitants to the square mile. Even in London itself, in different districts, the mean duration of life is proved to be greater or less by 15 to 20 years : a difference admitted to be much greater than any preconceived opinion could have surmised. It is not surprising, under such circumstances, that differences of life-expectancy should be so much greater in rural districts, as they are found to be. And yet, notwithstanding this, and notwithstanding that England and Wales have a larger proportionate city-population than any of the continental nations, it is ascertained, as will have to be particularly noticed afterwards, that the expectation of life in England is greater than it is in any of those countries ; and this may be, in a great degree, ascribed to better drainage, sewerage, and ventilation,—and is, so far, a triumph over the disadvantages of the accumulation of life in our cities,—and probably a triumph over the proverbially uncertain skies, and damp and cold climate, of Great Britain. But, how much more might be done in this respect than has been done hitherto,

is the more important and practical question. The widening of streets,—the improvement and enlargement of sewers,—the removal of butchers' slaughter-houses, and of cattle-markets, from the midst of the towns,—the interment of the dead in the more thinly peopled suburban or rural districts,—the wholesome supervision of manufactories, preventing all such from being carried on in districts having anything above the general average of the population of the kingdom, that can be proved to deteriorate the atmosphere in an extensive, or even in a marked degree,—the efficiently prevented accumulation of ashes, bones, hides, and the like, within the police-boundaries of any of the towns,—are some of the more important of the means of adding to the health of towns, and of making them to be sources of unmixed good to the nation, as centres of civilisation, sources of educational and general enlightenment, marts for other things besides the physical materials of existence, or the comforts and luxuries of social life, and as channels for the disposal of other commodities than simply those considered as agricultural produce, such as the educational, intellectual, and social advancement of all classes of the people, with less and less of the evils of shortened life, by which the realisation of so much good has been unquestionably to some degree counterbalanced. The cessation of the plague, and the generations that have gone by since its last appearance in this country, afford the strongest and best proof of the degree to which disease may be counteracted, or, as in that case,

altogether removed, from the pent-up-life in cities : a disease, which, if now as fatal as it was in some of the early years of the 17th century, might multiply the mortality of London alone by not less than thirty times. There can be no doubt, that the mortality and the expectation of life, in the worst districts, and the least densely peopled parts of the crowded cities, might, by full sanitary regulations, be reduced at least down to that of the most favoured of the town districts,—and that the mortality of these better town districts might be reduced to a point much nearer to that of the rural districts than at present obtains ; and medical men will not have done their duty to the public, whose inertness is principally owing to ignorance, until this becomes the common conviction of the people and their rulers, and every effort is in fullest operation to determine its truth. The statements made, in Mr. Farr's own words, in the Appendix to the First Annual Report of the Registrar-General, are more extraordinary and positive evidences of how much might be done to ameliorate the condition of many of the inhabitants of cities, than almost anything which could be advanced on the subject. Mr. Farr says, “ The annual rate of mortality in some districts will be found to be 4 per cent., in others 2 per cent. ; in other words, the people in one set of circumstances live 50 years, while in another set of circumstances, which the registration will indicate, they do not live more than 25 years. In these wretched districts, nearly 8 per cent. are constantly sick, and the energy of the whole population is

withered to the roots. Their arms are weak, their bodies wasted, and their sensations embittered by privation and suffering. Half the life is passed in infancy, sickness, and dependent helplessness. In exhibiting the high mortality, the diseases by which it is occasioned, and the exciting causes of disease, the abstract of the registers will prove, that while a part of the sickness is inevitable, and a part can only be expected to disappear before progressive social amelioration, a considerable proportion of the sickness and deaths may be suppressed by the general adoption of hygienic measures which are in actual but partial operation. It may be affirmed without great risk of exaggeration, that it is possible to reduce the annual deaths in England and Wales by 30,000, and to increase the vigour (may I not add the industry and wealth?) of the population in an equal proportion; for diseases are the iron index of misery, which recedes before strength, health, and happiness, as the mortality declines."

Supposing, as appears to have been proved, that man respire, on an average, twenty times in a minute, and that at every respiration he inhales 16 cubic inches of air, of the 320 cubic inches thus passed through the lungs, 32 cubic inches of oxygen are consumed. Of every $22\frac{1}{2}$ grains of carbonic acid expired, about $6\frac{1}{2}$ grains may be said to be carbon, the remainder being oxygen; and it has been inferred, by simple calculation from these premises, that a man inhales during the 24 hours about 266 cubic feet of air, weighing 20 lbs.,—that he consumes 27 cubic feet

of oxygen, weighing about $2\frac{1}{4}$ lbs.,—that the carbonic acid expired weighs at least $2\frac{1}{2}$ lbs., of which 11 ounces are carbon and the remainder oxygen. Some have computed the weight of carbon expired daily to be considerably less than this: as little as 7 ounces; but it seems probable that 11 ounces of carbon are not more than are expired daily from the lungs, on an average of the whole population. To this account must be added, the disengagement of upwards of half a pint of water in the air expired. The amount of ventilation necessary for the purposes of health, must be such as will secure to the system the proportion of oxygen required to maintain the elevated temperature of the body, and to carry off the carbonic acid, and as will serve to remove the aqueous exhalation from the lungs. The amount of ventilation, the rapidity of the change of the air, must be greater, in direct proportion to the quickness with which the air is vitiated, either by the number of people occupying a given space, or by the consumption of oxygen by means of fires or otherwise. The importance of ventilation is likewise greater when the air is warm, than when it is cold, for the reason that warm air is by so much rarefied, and contains a correspondingly smaller proportion of oxygen in a given volume. It is quite evident how important the question of ventilation must be in the between-decks of ships of war, where as many as 500 men are sometimes crowded together on the same deck, the hammocks being slung as close to one another as can by possibility be accomplished. The importance of ventilation is great

in such a case as this, where, from circumstances, the other conditions of life are for the most part peculiarly those of health: where the diet, and the temperance, and the cleanliness, and the regular exercise, and the freedom from mental anxiety, and the excitement of duty, are all so strongly in the favour of the individual. The importance of ventilation is great, and very great, in the crowded barrack-room of the West Indies, where heat and malaria contribute so fearfully to the amount of liability to disease, that the average proportion of cases of illness is double that which obtains among the troops employed in these temperate regions, and the general fatality of the cases is found to be no less than trebled. And, even in these fearful circumstances, ventilation of the dormitories has done much,—and might, if carried out fully, do more,—to lessen the amount of the sickness and mortality. But, at home, in the United Kingdom, in the classes of people that are less subject to the wholesome controul and kind superintendence of those above them in the social scale,—where the day's wants are not so statedly ministered to, and their supply is perhaps subject to much vicissitude, and is often and for long periods reduced below the physical requirements of the system,—where intemperance so often helps to derange the organism,—the value of ventilation, as a means of public health, becomes even more conspicuous and important, and strikingly deserving of the attention of the philanthropist. Free ventilation may be the single means within the gift of

the public, by which the physical lot of our poorer fellow-subjects may be ameliorated; and it may be the efficient means by which fever, with all its suffering and its fatality, is kept away,—the means by which the energies of the system are maintained in the best state for the maintenance of health and life, on a minimum of food. Respiring an impure atmosphere deranges the functions of the economy,—interferes with the processes of assimilation and expenditure,—prevents the best use being made of the alimentary supplies, be they small or great,—depresses the nervous energies,—and predisposes to disease from any exciting cause, whether calculated to induce sporadic, endemic, or epidemic disease. It may occur to any one who thinks on this subject, how much more good, real lasting good, might often be done to the wretched inhabitants of the crowded room by an improved ventilation, than by the eleemosynary charity which is so often and so grossly misused.

In the evidence as to the workshops, those used by tailors especially, the strongest proofs were given in the parliamentary inquiry, as to the extent and the evil influence of deficient ventilation; the shops being thus rendered so close and so hot, by the animal heat, the uncarried off pulmonary and other exhalations, the high temperature of the stoves for heating the irons used in the business and of the irons themselves, that, even in summer, the temperature of the shop has been ascertained to be twenty or thirty degrees higher than that of the

external air,—that the men have been covered with a profuse perspiration,—that, in a large shop, forty or fifty pounds' worth of light-coloured goods have been damaged by the damp hands of the men in a single season,—that so much exhaustion has been induced, that numbers have been unable to stay out the hours, and been obliged to leave earlier,—that the appetite became impaired,—that the use of stimulants, to an extent destructive of health, became gradually more and more necessary, or seemed to be so,—that ardent spirits were taken the first thing in the morning before food could be eaten, and drams of spirits were taken at three stated times afterwards during the day. It appeared, that the expectation of life was thus diminished by at least one-third. Moreover, in the case of milliners and dress-makers, from the same cause in a great degree—deficient ventilation of the work-rooms, although partly, no doubt, from late hours, and deficient sleep, and defective or improper nourishment, and neglected out-of-door exercise, the probable duration of life was curtailed to the same extent. Add to these great instances, that of the wretched weavers, whose habits or prejudices lead them to exclude purposely as much air as possible, from the work-room, from the opinion that it damages the costly fabrics they are doomed to manufacture at the cost and sacrifice of earth's chiefest blessings,—or that of the miner, not only robbed of the light of day, and to some degree of the free ventilation of the air, during his hours of labour

underground, but often lodged in miserable and unventilated and over-crowded places, in the lodging-houses in which he finds quarters during the night,—or, in fine, that of the great masses of the labouring poor, at least of those living in the towns, who are crowded into rooms that are unaired, and little if at all visited by sunshine, not to speak of their being surrounded by other sources of impurity and disease,—and can we wonder at exhaustion and pallor, or even blame unpitiously; or without much qualification, the sad abuse of stimulants, which so aggravates eventually all the other evils,—can we wonder at visitations of epidemic disease, at the greater number of cases of severe sporadic disease,—can we wonder at the much shortened life, at the accessions to the numbers of the widows and the orphans, at over-burdened pauper-lists, or at any amount of destitution or immorality? Too much cannot be said or thought about the effect of ventilation, in increasing the expectation of life, in raising the value and character of existence, in improving the physical condition, and with it to some necessary extent, the moral character, of the masses of a city-population. In many of the great factories, and in public hospitals, much has been done in this way,—and too much praise cannot be bestowed upon those by whom the poor and the afflicted have been cared for in this essential particular; but the good may be carried farther, with much additional advantage, in the majority even of these more enlightened instances of philosophic endeavour; and it must be extended

to the smaller workshop and workroom, to the poor man's dwelling and his dormitory, if all the good is to be derived from an acquaintance with the usefulness of a full and free ventilation, that we are entitled to expect from it. The amount of good from what has been done, is large beyond any preconception that could have been entertained;—the diminished mortality of the sick in the hospitals,—the improved health, and greater aptitude and quickness at their work, of the operatives in the factories,—have been the rapid and extensive consequences of every step in advance that has been taken in this matter. And it should be borne in mind by all who draw together numbers of people into large buildings,—whether from a philanthropic wish to cure their ailments,—or from a selfish wish to support paupers at the cheapest rate,—or from the mercenary wish, using the expression in no invidious sense, to increase their own commercial gains,—that it is their bare duty to provide that this is not followed by any injurious consequences to those, who are the creatures of their benevolence, or the tools of their aggrandisement;—that there is ever much risk of injury to individual health, by collecting large numbers of people into the same building, for any lengthened period of time;—and that this risk is only to be prevented, by adopting the fullest means of satisfactory ventilation, to carry off the concentrated animal miasms which are so detrimental to health and to life, whether acting insidiously and gradually, producing cachexia with all its consequent morbid

states, or rapidly engendering endemic or epidemic disease.

The calculations, as to what is to be considered an adequate supply of fresh air for every individual occupying an apartment, have varied a good deal. The comparatively low estimate of Mr. Tredgold, states that there should be 4 cubic feet of fresh air per minute, for each individual; whereas Dr. Reid seems to think that not less than 10 cubic feet per minute is only an adequate supply for every person. "In a room," says Dr. Reid, "12 feet square and 12 feet high, containing, therefore, 1728 cubic feet of air, there are ten persons who respire the whole air in the room in $15\frac{1}{4}$ hours, and require a complete change every 17 minutes in order to supply them with 10 cubic feet per minute. Such a change might be effected by the ingress and egress of air through apertures, 1 square foot in area, at the rate of 100 feet per minute, or $1\frac{1}{7}$ mile per hour. In the same manner, in a church, 80 feet long, 50 feet wide, and 40 feet high, containing therefore 160,000 cubic feet, there may be 1000 persons. For their supply there would be required a change every 16 minutes, or about 20 tons of fresh air every hour."* Inhabited rooms should then either be large and lofty, in order to contain such a number of cubic feet of air, in proportion to the number of its occupants, as will secure the maintenance of the atmosphere in a state of adequate purity, by means

* Dr. Reid's "Illustrations of the Theory and Practice of Ventilation."

of a gentle current of air passing in and out of the apartment; or if the rooms are smaller, or the number of occupants greater, the currents of air in and out of the room must be more rapid, or the ventilation must be defective, and the condition of body and mind must suffer in the same proportion. The quotation from Dr. Reid furnishes numerical data, that are probably sufficient guides as far as figures can be so; the truth being, however, that, in the first instance, the sensations of a person unaccustomed to respire a vitiated atmosphere,—and, in the second place, the physical condition of the miserable and habitual victims to the use of an impure air, afford indications that cannot be mistaken. It is probable that none of the public places, in which the people of this country are collected together in considerable numbers, the larger and loftier churches alone excepted, have an internal area that is sufficient for the respiratory uses of the numbers of persons assembled, without so rapid a current of air through them, as to form a serious inconvenience, if not to become in itself a direct source of evil, to those who are within the influence of such currents. These remarks apply to theatres, ball-rooms, courts of law, public dining-rooms, and other familiar instances of much frequented or crowded public places; and the headache, and the general sense of lassitude, so commonly experienced, especially by the more feeble, and those particularly in whom the respiratory function is performed less vigorously and fully, and in whom the blood is

therefore most easily deteriorated beyond the physical sufferance of the economy, are the familiar examples of this fact. Such consequences are sufficiently undesirable, and, under some circumstances, may not be unattended with immediate or remote risk to health, or even life; as, when many days or nights are passed in an atmosphere so vitiated in its character, or when the general powers of the system are enfeebled, or when the respiratory organs in particular are disordered, or prone to become so; or, in another way, by the heat of so many living furnaces being so inefficiently carried off,—the pulmonary exhalations, and those from the skin, increasing the humidity of the air, and by the consequent risk of a sudden and great chilling of the system on re-exposure to the external air,—the nervous and vascular powers being in an unfit state to restore promptly the equilibrium of the circulation, from the depression and exhaustion that attend the imperfect oxygenation of the blood. Such evils as these are so evident and so easily obviated, that it is wonderful to find how little they are considered in providing accommodation for large assemblies, even of the wealthy and intelligent classes of the community. The architect is indeed unworthy of public confidence, and unfitted for the execution of his commonest duty, to whom the area necessary for the respiration of any required number of people, and the minimum current of air to be maintained through it for the respiratory wants of its occupants, are not primary considerations and familiar ideas. The

current of air from without, should generally be admitted either by numerous small openings in the different sides of the apartments, so as to lessen the risk of danger to any of the occupants from the draught of air, or it should be admitted at a place where the people are not within its more immediate influence. If the external air is too cold, it may be warmed,—if too warm, it may be cooled,—if too dry or too damp, these conditions may be modified without difficulty, by simple chemical and mechanical contrivances. Under some circumstances, such contrivances may be useful and even necessary; but the best of all means of ventilation, must yield to that of making rooms of so sufficient an area, in proportion to the number of persons they are meant to contain, as will secure an efficient supply of unvitiated air to every individual, at the expense of the slowest current of air from without being admitted into the apartment. It is of course understood, that this applies particularly to the buildings of these colder latitudes; and that it applies to the living-rooms and dormitories of the dwelling-house, as well as to public buildings and public rooms.

One great practical disadvantage of deficient ventilation in the dwellings and sleeping-rooms of the people, is that the feelings so soon get reconciled, and more than reconciled, to the close and unwholesome atmosphere,—that the warmth, the sense of lassitude, the dreamy faculties, are not apt to be regarded as evils by the children of poverty and toil,—that the opening of a casement, or the enlargement of a flue,

or the insertion of a circular ventilator in a window-pane, or the removal of a brick from the wall over the door-way, makes more exertion, more self-discipline, more food, and more fuel in cold weather, needful to immediate comfort; and ignorance and habit are the sulky and obstinate antagonists to be encountered, on the very threshold of philanthropic endeavours to ameliorate the condition. But fever, in its major or its minor types and phases,—but the needlessly large mortality of the cities,—but the waste of life, in infancy from cachexia, in early maturity from phthisis, in middle life from this and the many other forms of sporadic disease, and at all ages from epidemic visitations,—are not to be lessened in degree, much less put an end to altogether, without securing to every one, by day and by night, asleep or awake, from infancy to the “last scene of all,” an adequate and full supply of unvitiated air for the due oxygenation of the blood, with all its important effects on the animal economy.

It may indeed be said, that the alimentary wants are directly proportioned to the degree to which the carbon of the system is expended by the amount of oxygen that is respired,—that people who are inhabiting an apartment that is inadequately ventilated, not only consume, but actually expend and require, less food, than those who are living in a pure and efficiently changed atmosphere; and it might be, although unwisely, inferred, that poverty, and the scanty meals of crude and coarse food, ought to be connected, as they are so commonly, with close and

imperfectly ventilated dwellings. But history does not tell us, that the means of subsistence of any people, or class of people, has been proportioned to their wants, nor to the facility with which they could be obtained,—but that they have been proportioned to the energy and individual effort directed to that end. History does not tell us, that any advantage is to be gained by accommodating the different circumstances which make up the physical conditions of existence, to the low standard of any one of those circumstances; but, on the contrary, that such a course has been only followed by the farther and farther depreciation of the social condition, and the farther degradation of the people or the class. Permit the refuse of a town to be collected, sifted, divided into ashes and bones and rags and bits of iron, and other similar articles, and vended as such for various purposes of manufacture, &c., by the poorest and lowest class of the people, instead of having all such refuse matters carried off in sewers, or removed by public scavengers; and although it might appear, that some means of subsistence would be thus afforded to a class who badly want it, yet in the practical working of the question, these circumstances really produce a class of people lower than the class which was previously the lowest,—a class steeped in a degree of misery and squalor and disease, greater and deeper than had been known before; and that which might have seemed to be humane, has been proved to be, in truth, a great wrong done to the class sought to be protected. Allow the house-

less wanderers to find a nightly shelter in the dry arches of the metropolitan bridges ; or let miserable outcasts dig holes and form cavern-like habitations in the sides of barren hills ; or let them take possession of waste lands, and erect wretched, mud-walled, and heath-covered, windowless and flueless hovels, to shield them from the rougher blasts and keener cold of winds and seasons ; and, in the same way as in the other instances, the numbers of such wretched beings are added to, in the direct proportion that such facilities are afforded. Give to such classes of any people, food and shelter of any kind, however insufficient and however miserable, with so much less of need for immediate efforts, or immediate and steady exertions ; and such class becomes, in the same proportion, multiplied,—and in the same proportion, farther degraded in the social scale. If a man can live, and his wife and children can live,—keep body and soul together,—by comparatively little labour, and only occasional exertions, as for instance by the cultivation of a potato-patch, it may be in vain that we expect or hope that he will farther exert his powers, and strive to earn a better coat, or warmer clothing, or a better diet, for himself and his family. Every advance in the use and enjoyment of the comforts, luxuries, and embellishments of life, becomes a moral engine for the elevation of character and the promotion of industry, as well as a means of physical good—of making men healthier, stronger, and longer-lived. In the most fertile regions of the world, where the climate and the soil afford all the physical condi-

tions for the supply of man's wants, it is by no means the case that the population is by so much raised above the condition of those, who have to struggle for the means of life in colder climates and more barren lands. On the contrary, it is under these latter circumstances, that the regenerators and colonisers of the world,—the authors of civilisation, the elevators of man's social condition, the peoples that have cradled science and art and learning and high morality,—have been produced; and from generation to generation, by steady and unavoidable efforts, and a consequently exercised advance of their cerebral organisation, have been farther and farther enabled to promote their own immediate benefit, and to add to the hopes and expectations of the whole human race. But, indeed, all experience goes to prove the same thing; and it were truly a false conclusion, to suppose that, because improved ventilation would add to the alimentary wants of the system, therefore the poorest class should be left in their close and ill-ventilated abodes. And this, even on the simple and broad principle that has been advanced, and independently of the facts which had been previously cited, which show that, although defective ventilation expends less of the materials of the body, and permits man to hold life at a less cost of aliment, yet there is involved a lower physical condition in the same proportion, a less power of resisting the common predisposing and exciting causes of disease, and therefore a greater liability to disease, and a greater proportional mortality from diseases when they do occur, than would

otherwise obtain; and this, it is to be observed, independently of the certainty with which the causes of epidemic and endemic diseases are thus produced, or are strengthened in their character,—and independently of the additions thus made to the sufferings and mortality of the class, and to the disease and mortality of all ranks and classes of the people.

“If we look,” says Dr. Reid, “to the fact, that less than half a cubic foot of air passes through the lungs of an adult in a minute, this estimate (of the air necessary for the purposes of the system—ten cubic feet per minute) may at first appear excessive; but if we remember, that, at each expiration, a quantity of air is emitted which mingles with an additional portion of air exceeding largely its own bulk, and that there are twenty such respirations per minute, while provision is also required for the air that affects the surface of the body, and for the endless variety of minor effects produced by furniture, lighting, heating, refreshments, &c., where no peculiar adaptations for these purposes have been introduced beyond those usually observed, it will be seen that the estimate is by no means immoderate. The real question is, not what the constitution can bear, but that amount which is conveniently accessible in ordinary habitations, and which is essential for the wants of the system. The power of the system in accommodating itself to peculiar circumstances, is very great. The amount of opium, wine, tobacco, ardent spirits, and other substances, which some individuals

can habituate themselves to, though only at the expense of impairing their constitutions, is no less remarkable than the varieties of atmosphere, loaded with impurities, in which others can breathe, and even work for years continuously. Perhaps the most singular instance of this kind, exclusive of those met with in polar regions, and in a rude state of society, is to be seen in mines, where it is frequently common for the men to work in an atmosphere too impure to permit a common candle to burn, though an oil lamp, in consequence of its greater tenacity of combustion, may be maintained in action without difficulty. But numerous individuals faint in an atmosphere far less impure than that of some coal-mines, and even death has been considered to have ensued in some instances from vitiated air, though it was not sufficiently impure to extinguish a candle, no impurity but carbonic acid being known to have been present."

The condition of the air as to dryness and moisture, affects very much the supply required by the system. The dry air carries off readily and rapidly the necessary exhalations from the lungs and from the skin, by so much relieving the system from matters sought to be removed from it; while the oxygen of the air and the circulating fluids of the body are, by so much, more completely allowed to produce the necessary re-action.

The effect of a burning lamp or candle on the atmosphere of apartments, in consuming the oxygen and evolving carbonic acid, is sufficiently considerable

in its degree, to make it of importance that the supply of air in a room, should be such as to allow for this, in proportion to the degree of artificial illumination; and such should not be made use of in a dormitory, unless it is of ample dimensions, or fully ventilated in proportion to the number of its occupants.

The effect of a fire in an open fire-place, if the fire is of moderate size, and the room proportionably large, is favourable to ventilation, by causing a current of air through the room, from the door or the windows to the chimney. The policy of this, however, depends entirely on the due adjustment of the question, as to the size of the fire and the dimensions of the apartment; and, unless the coldness of the weather be very severe in degree, or the individual be of such delicate habit of body, that much would be risked by exposure to an unwarmed air, or unless the room be very large, and admits of the most satisfactory degree of ventilation, a bed-room without a fire should be always preferred. If free ingress of air is secured, and the size of the room or the smallness of the fire, renders the risk of the air of the apartment becoming unduly heated, so small as not to be worth considering, the effect of an open fire in any room must be, to promote the current of air through it, and to subserve the purposes of ventilation. Even if there be no fire in the grate, the long open flue must afford a valuable channel for the passage of air; and a fire-place with an open chimney, should accordingly be provided in every room of every house,

and more especially in every sleeping-room. Stoves or braziers, for the burning of charcoal or other fuel that produces no visible or irritating smoke during combustion, are too manifestly dangerous and unphilosophical, to require more than a passing word of caution. Where open fire-places can be had, as in Great Britain, and coals or wood in sufficient quantity, a stove without adequate flue or chimney should never be seen.

Rooms, and especially sleeping-rooms, should on no account be unduly heated. The effect of this in rarefying the air, has been mentioned; but, moreover, the system of the occupant becomes heated, and the vessels of the skin excited,—and the result is, either an excessive secretion from the surface of the body, and consequent and probably injurious exhaustion, or a hot, dry, and feverish skin,—and the farther consequence is, increased action of the organs of circulation, undue fulness of the vessels, and undue pressure on the nervous system, with the effect of rendering the sleep either lethargic and unrefreshing, or disturbed and interrupted by the general excitability of the system. Such effects of an overheated atmosphere on the bodily conditions, are sufficiently familiar. Even in the sitting-room, although for obvious reasons it is less marked in its degree, an overheated atmosphere commonly induces a perceptible sense of oppression in the breathing, succeeded by a feeling of drowsiness and torpor, which, if not relieved, is either followed by a deep and heavy sleep, or by restlessness and nervous irritability, to

be succeeded by languor and exhaustion. Such effects must be familiar to all who have ever occupied an unduly heated bed-room.

The air of the bed-room ought, then, to be kept at as low a temperature, as is consistent with the feelings and the health; and means ought always to be in operation, by which a constant and sufficient change of the air may be secured. In some cases, the open fire-place, whether with a fire in the grate or without one, may be sufficient to attain this end; and in other cases, the partial opening of a window at the top, or a circular ventilator in one of the window-panes, may be necessary.

For the purpose of securing the adequate ventilation of the bed-room, there should be as little of drapery and curtains about the bed as possible, and the tester of the bed should generally be as lofty as the room itself,—if indeed curtains and tester may not be wholly dispensed with. If the bed-room is not of adequately large dimensions to justify them, no tester ought to be allowed, and no more of either curtains or drapery than may be requisite to obviate the risk from any current of air, that is found likely to influence the occupant of the bed. There can be no doubt, that furniture of all kinds interferes in a greater or less degree with ventilation; and the fact may judiciously influence the extent to which it is admitted into bed-rooms; and it should be remembered particularly, that all woollen articles, as carpets, absorb the moisture from the expired air, or in damp weather from the atmosphere, rendering the

air of the room by so much less pure and more relaxing,—and that such fabrics should be dispensed with in sleeping-rooms, as far as comfort and convenience will permit.

The great degree to which gas is made use of as the means of illumination in bed-rooms, makes it necessary to animadvert upon and condemn the practice in a pointed manner. Indeed, the use of gas at all in dwelling-houses, unless in passages or lobbies, or in very large and lofty and amply ventilated apartments, can hardly be too strongly condemned. In itself a poison, coal-gas cannot be burned in any hitherto contrived way, without allowing some portion of it to escape unconsumed; and if this is permitted to diffuse itself through the apartment, however much it may become diluted, it must be in some greater or less degree noxious and objectionable. I have repeatedly known bad effects to be produced by this; and indeed, have repeatedly experienced them. Even in the theatre and the ball-room most persons must have felt the headache, giddiness, and sense of faintness, which this unconsumed gas occasions. The effect produced by breathing carburetted hydrogen, however much diluted, night after night, during sleep, may be more insidious and less perceptible, but cannot be eventually less important. If the unconsumed gas is carried off by special means, and not allowed to enter the apartment, or to be mixed with its air, the objections to gas as a means of illuminating the dwelling and sleeping apartments, are of course done away with. This appears to be very efficiently

done, in the case of the exclusive gas-burners, so fully described in Dr. Reid's work.

The bed-room ought seldom to be on the ground-floor of the house; and it should generally be on the first floor of the house, rather than the second. It should be, in fact, sufficiently removed from the influence of dampness, or any exhalation from the ground, and yet as far as possible away from the varying temperature, inseparable from being near to the roof of the dwelling. This is necessarily the more important, the greater the influence of the sun's rays. For the same reason, it may be sometimes advisable that the bed-room should not be on the sunny side of the house.

Before leaving this particular subject, it may be right to mention the common practice of having the bed artificially heated,—by means of a warming-pan, containing burning coals, or burning charecoal, or a heated iron chain. Unless under very particular circumstances of debility, and deficient calorific power of the system, this must be as unnecessary a custom, as it must always have a relaxing and debilitating tendency. Even when temporarily indicated by morbid conditions, the indication and necessity should be sought to be removed by such means as a regulated diet, temperance, daily exercise, if possible in the open air, friction, &c.; and the artificially heated bed may be often at once dispensed with, by the use, temporary or otherwise, of the old-fashioned expedient of a bottle filled with hot water, or a heated brick, placed next to the feet in

bed; and this may be sometimes wisely assisted, by suggesting the use of calico instead of linen sheets.

The importance of a due adjustment of the temperature of the sitting-room, is only second to that of such careful regulation as to the heat of the bedroom. A temperature of 50° of Fahrenheit's scale, is generally sufficiently high for the air of the bedroom; and that of the sitting-room may be usually 10° or even 15° higher than this. The cooler the air of the sitting-room, consistently with the maintenance of the due temperature of the surface and extremities of the body, the better; and if enough of muscular exercise is taken, if a sufficient number of the muscles is made use of, and if the individual is as much out of doors as he ought to be, it will seldom happen, that, if not especially invalided, a higher temperature than this will not be felt to be undesirable by the party himself. Any one accustomed to take sufficient exercise in the open air, will instinctively object to a close, or imperfectly ventilated, or unduly heated room. It is usage alone that can reconcile the sensations to such an atmosphere; it is usage alone that can so blunt the natural sensibilities of the system, as to render an impure atmosphere of any temperature otherwise than uncomfortable, and ungrateful to the feelings. There are few things more observable, than the stupifying effects of a hot room on the social and family circle, or than the difficulty of applying the mind to serious business in a heated atmosphere.

Perhaps enough has been said as to the temperature of rooms. It should be always borne in mind, that the question of ventilation must ever go hand in hand with that of temperature, if the sanitary condition of the air of the apartments is to be considered to be satisfactory. The higher the temperature, the more rapidly must the air be changed. As has been said, the risk of an insufficient degree of ventilation must be less, when there is an open fire-place in the apartment, with a sufficient and open flue, whether with or without a fire in the grate. If any required degree of artificial temperature is to be obtained by means of hot-air pipes, or hot-water pipes, or steam-pipes, or in any similar way, such assistance to the ventilation is not afforded; and the risk of a high temperature, and consequently a rarefied air,—of relaxation of the system, and deficient oxygenation of the blood,—must be so much the greater. When there is an open fire-place, with or without a moderate fire in the grate, in an apartment that is of sufficient size for the number of its occupants, it must be seldom the case that any more active or unusual means of ventilation need be resorted to. Under other circumstances, special channels for the supply and egress of air may have to be provided,—particularly if the coldness of the season or the climate interferes with the keeping doors or windows often or always opened. As to the means of ventilation, Dr. Reid's work is one of the best guides, as to details as well as principles; although it may be probably added, that, as frequently happens to a man of genius

and enthusiasm, the views seem to be carried farther in some instances, and the practical detail is occasionally more minute, and perhaps more extensive, than appears to be needful for the healthiness, or than might prove conducive to the comfort, of our dwellings.

The subject of climate and its effect on the health of man, is one that branches too widely, and embraces too many inquiries, and too large a number of facts and circumstances, to be adequately noticed in this work,—or probably, even in the present advanced state of vital and general statistics, to be as yet adequately and definitively discussed.

The climate of the different countries of the world, depends upon some more prominent or primary conditions, and upon a number of less prominent and secondary conditions; and some of the conditions, and of the latter class especially, are liable to be modified by many circumstances, which may influence different years, or different seasons, or may cause a progressive alteration in the character of the district, and a corresponding change in its effects on the physical condition of its inhabitants.

The more prominent conditions which affect the climate of a place, are, its distance from the equator,—its elevation above the level of the sea,—its insular or continental position,—its geological character, and the nature of its soil,—the direction of the prevailing winds, their character, and their force,—the variations as to temperature, whether between that of the night and that of the day, or those of the different

months or seasons of the year,—the amount and character of its rains,—and the electrical states and changes of the atmosphere. The secondary conditions, many of which may depend intimately on some one or more of the foregoing, are, the character, &c., of the vegetation,—the degree of shelter from the winds,—the extent of the drainage,—the character of the water used for domestic purposes,—the degree to which the existing animal or insect life affects the human population,—and the degree to which extinct and decaying organisms affect the health of the people.

The abstract question of temperature is one of the most important of the circumstances that modify man's adaptation to the globe he lives on. This seems, however, to be a more important matter, in regard to the risk incurred by those born in one latitude who migrate to another latitude, than as to the health and chances of life of the natives of the different regions of the earth. For, although the expectation of life is unquestionably greater in England than it is in most European countries, and greater in Europe than in America, and in America than in Asia, and in Asia than in Africa; yet the natives of the different regions of the world attain an average duration of life, which goes far to justify a belief that full and due attention to all the known means of health and preventives to disease, might almost serve to equalise the chances of life throughout the world, to those acclimated by hereditary circumstances, and usage from the infancy. But for a

man whose organs and tissues have been gradually fashioned and accommodated to one set of physical circumstances, by the conditions of his own existence, and those of the existence of successive preceding generations,—as for example to the maintenance of life at a mean temperature of 50° , to migrate to a country of which the mean temperature is 80° , must militate much against the probable expectation of life, and as largely against the chances of health. Under such circumstances, the disturbing influences must be constant in their operation, and of importance in their character,—the power of adaptation, variable and generally insufficient,—and the risk of disturbance from the extra duty demanded of different organs must be considerable; and, accordingly, there must arise a liability to suffer from morbid conditions, comparatively little known to a native population acclimated to the temperature,—as well as a peculiar susceptibility to suffer from the indigenous ailments, common to the population of the country, and to suffer from them severely. The balance between the action of the different organs, by which the general expenditure of the system is regulated and secured, must be maintained, or health must suffer, and disease ensue. The skin, lungs, kidneys, liver, &c., are so many great emunctories for carrying away the effete and redundant matters from the economy; and these organs act relatively more or less, according to the temperature of the atmosphere. In cold air, the system must consume more carbon, and require a larger supply of oxygen; and the

lungs and the kidneys have more duty to perform in the same proportion ;—in warm weather, the skin, the liver, and the mucous membrane, become the more active organs, and the greater means of carrying off the water ; and by so much are these organs severally more liable to derangement of their functions. As, in our own latitude, the greatest risk of disease is incurred when the temperature changes from heat to cold, or from cold to heat, and pulmonary or gastric affections become more or less general accordingly, so is health by so much damaged, the chances of life by so much lessened, and disease or its forerunners by so much increased, as man migrates to a climate that differs much in its average temperature from that of his birth-place.

The elevation of a district above the level of the sea, diminishes, in a definite ratio, its mean temperature, owing to the greater rarity of the air, and its correspondingly less capacity for caloric ; to which causes must be added, in many cases, the greater exposure to the influence of winds, and a greater liability to electrical influences. It is a sufficiently near estimate for practical purposes, that the mean temperature of a district is lower by one degree of Fahrenheit's scale for every hundred yards of elevation ; and, supposing this to be so, it serves to show, that, even at the equator, an elevation of some 15,000 or 16,000 feet, is within the region of perpetual snow, —and that the snow line is in these higher latitudes, at less than the fourth part of this elevation. Other influences, however, besides that of latitude, affect the

elevation at which the snow-line commences: such as the exposure of the mountain side to the south or to the north, which may make a difference of several hundred feet in the elevation of the snow-line, when all other circumstances are apparently equal. Making all due allowance for such modifying circumstances, however, all the different climates of the world, as regards their respective mean temperatures, may be found within a couple of day's journey,—gradually ascending from the burning plains of the tropics, to the everlasting snow of the mountain summits. In some instances, the climate of whole districts, or even whole countries, is thus modified by their elevation; and their mean temperature is found to be so much lower in proportion to their altitude. In noticing the principal climates and countries of the world, we find this to be singularly illustrated in the instances of the eastern and western sides of South America,—in the mountain lands of the interior of Jamaica, compared with the coast,—in the comparatively low mean temperature of the republic of Mexico, with reference to its latitude,—in the mountain ranges of Asia, where the Himalayas and Neilgherries afford a European climate to the invalided and exhausted system of the Anglo-Indian. And not only is there the marked difference in the mean temperature, corresponding to the degree of elevation, but the equally marked difference in the vegetable productions and vegetable capabilities of the district; and the Anglo-Indian surrounds his mountain retreat with the fruit-trees,

and other garden-produce, of his far away native land. If an untravelled man might be allowed to envy the travelled any one of his experiences more than another, it might well be that enjoyed during an ascent from the plains of the tropics, with their burning temperature, and lurid atmosphere, and enervating land-winds, where grow the spice-plants and sugar-cane,—finding himself, as he ascends, leaving these, and the indigo-plantations, and the coffee-lands, and the rice-fields, the palms and giant ferns, gradually behind him,—and, in the course of a few miles, passing through the districts of the cotton-plant, the maize, and the orange, to those of the grasses and cerealia, the olive and the vine,—thence to those of the oak, and other forest trees,—in their turn, to lose all traces of these, the hardy pines only living in the colder and colder regions to which he ascends,—soon to leave even them behind, and the hardiest forms of vegetable life, and arrive at the regions of perpetual snow. These frozen districts exercise, in all latitudes, but more particularly within the tropics, an important duty, in tempering the air which passes over them, and moderating the heats of the districts that those winds subsequently pass over. The winds which have blown over large tracts of land in the interior of the great continents, exposed to the direct and vertical rays of the sun, become more and more heated by the untempered influence of the solar heat, the solar rays influencing the air directly in their passage through the atmosphere, and indirectly in their radiation from the earth again, so far

as to become at length injurious to animal and vegetable life,—enervating the one, and blighting the other, to an extreme degree. And when neither tempered by vegetation, nor moisture from seas or lakes, the effects are increased to the last degree. Contrasting the wind that has blown over the great desert of Africa, and its subsequent scorching effect on the whole south coast of Europe, and on the islands in the Mediterranean, and on Egypt, with the effect of the wind that has blown over the Himalayas or the Andes, in moderating the temperature of the countries it subsequently traverses, affords a vivid illustration of the important influence of mountain ranges on the climates of the world. The effect of mountain ranges in collecting clouds, adding to the local amount of rain, and furnishing springs and river sources, to irrigate and fertilise the lower districts, independently of their acting as reservoirs of snow during the winter, and affording supplies of water to the streams during the summer months, ought not to be passed over in entire silence.

The ocean exerts a great and important influence on the climates of the earth; and, of course, islands, the coasts of continents, and the whole of the smaller continents, and the peninsulas, are most subject to this influence. The effect of the ocean on the climate of the land, is not to increase, or even as it should seem, to diminish, the mean temperature of the country,—the mean temperature being determined rather by the equatorial position, the character of the prevailing winds, and the elevation; but the effect

of the ocean is to diminish the degree, the frequency, and the suddenness, of alternations of the temperature. The temperature of the sea in the different latitudes does not appear to differ in any important degree, from that of the coast which it washes ; and its influence must be chiefly, so to temper and modify the temperature of the land, as to diminish the heats of summer and the cold of winter. In the smaller islands subject to the influences of the ocean, this effect is very remarkable and important,—modifying the climate to a great degree, from that which would be produced by the equatorial position and other influential circumstances. It is found that the island of Madeira, for instance, the Azores, &c., in the Atlantic Ocean,—the islands in the Mediterranean Sea,—the Channel Islands,—the Isle of Wight,—and the Isle of Man,—all have climates that are much influenced and modified by the ocean, as to extremes of temperature, as to the character of the different seasons of the year, as to the mean quantity of rain, and as to the character and frequency of the rains. Besides the great effect of the ocean on the climates of different countries, in equalising the temperature, and moderating the extremes of heat and cold, and the suddenness and the degree of the changes in the atmospheric temperature—an effect so important in its results, and yet so simply the consequence of the way in which caloric is communicated from particle to particle of all liquids, by their becoming severally of greater or less specific gravity as they are colder or warmer, and rising or sinking to and from the surface accordingly ;

the temperature of the surface and that of the depths being thus maintained in due adjustment; and the air passing over the sea being deprived by so much of its caloric when it is warmer than the ocean, and raised by so much in its temperature when it is colder;—besides this effect, the ocean has another climatorial action on the air,—charging it with a degree of moisture proportioned to its temperature, and its consequent capacity of holding the aqueous vapours in solution. When air thus charged with vapour passes over colder districts, or when subjected to electrical influences, being no longer able to retain and suspend so much water, the separated vapour falls to the earth in the form of rain, to fertilise the earth, cover it with vegetation, and equalise directly and indirectly its temperature. The precipitation of the vapour from the air may be brought about or promoted by a colder latitude, or by mountain ranges, serving at once as electrical conductors, and as condensers, from their lower temperature, of the atmospheric vapours; and hence maritime districts, and insular and peninsular countries, are subjected to more rain, in proportion to their latitudes and other circumstances, than the interior of continents; and when the interior of continents do not happen to present mountain elevations proportioned in altitude to their propinquity to the equator, they become, in the same proportion, remarkable for the rarity of their rains: in some remarkable instances, rendering the occurrence of rain as unfrequent as at intervals of years, and leaving the country during the long

drought well nigh destitute of vegetation, and, according to its geological character, either naked rock or sandy desert.

Such are, no doubt, the chief and most important effects of the ocean upon the climates of the earth. They are necessarily more remarkable in the insular and peninsular countries. The climates of all countries near to the sea-coast must be more or less influenced in the same way, although by no means to the same extent; one side only being exposed to the maritime influences, the other sides being affected by the continental conditions, the equatorial, and other circumstances; and the temperature, &c., being perhaps principally determined by them. Countries on the sea-coast, however, have, in some cases, their climate influenced, to a very important degree, by the maritime temperature, and the other influences of the ocean on the atmosphere; and more particularly, if the prevailing winds are from the seaward; and still more so, if the district happens to be sheltered from the land winds, either by high grounds or dense forests.

In noticing the effect of the sea on the climate of the land that is more immediately adjacent, it is a secondary, but by no means an unimportant circumstance, as regards the sanatory conditions of the atmosphere, that the air becomes in some degree charged, while traversing the ocean, with saline, as well as merely aqueous matters; and, thus holding iodine, and other important constituents of sea water, in solution, may be readily understood to exercise a

considerable effect on the human system. As regards cases of functional disturbance, and still more as regards many cases of organic disease, this circumstance may be of primary importance; modifying and determining the judgment of the medical man, as to the selection of such a locality for the residence, temporary or otherwise, of the invalided,—or as to the avoidance of such an atmosphere altogether. The effect of the maritime atmosphere is necessarily more or less stimulating; and perhaps particularly so, to the lymphatic and glandular systems. And accordingly, the air of the coast is found to be of great use in many cases of scrofulous character, independently of the advantage probably derivable from the tempering of the summer heat and the winter cold. On the other hand, in many cases, the stimulating effect of the saline air may be more than the system can endure with impunity, or without direct and manifest injury. This is often illustrated in cases of disease of the heart or its great vessels, in advanced cases of disease of the brain, in cases of confirmed arthritic disease, and even in the latter stages of pulmonary and hepatic disease. Whereas, in the earlier stages of pulmonary affections, and in the minor and earlier degrees of hepatic derangement, the stimulating effects of the air of the sea-coast are not only well borne, but are obviously advantageous to the economy and power of the system; and may aid, in an important degree, in the restoration of health. In the cachexia, unhappily so common in the children of the large towns, breathing habitually an atmosphere

so vitiated by the density of the population and other causes, the effect of the air of the coast is well known to be beneficial and restorative, in an eminent degree. The amount of the stimulant action of the saline atmosphere is apt to be greater, in proportion as the air that has been breathed habitually, is more moist, dense, and relaxing. And accordingly, circumstances which might justify removal from an inland, upland, or mountainous situation, to the sea-coast,—or from an open and pastoral, or even from a well-drained and rural district,—might not justify such removal from a low, damp, rural district, or from the inefficiently drained and badly ventilated districts of the towns.

There is an observation of much practical value, that has been too little attended to, in the practical adaptation of the great hygienic fact of the stimulant air of the sea-coast. The influence of the saline impregnation of the air extends inland for several miles,—gradually becoming less and less considerable, until it ceases to obtain, in an evident degree, from ten to twenty miles inland; unless when a high wind blows from the sea-ward, when the saline matters may be shown to be present in the air, by means of chemical reagents, to a greater distance inland than even twenty miles. The tempering and equalising effect of the sea on the temperature and climate of a country extends very much farther than this: so much so, as to modify the whole climate of Europe, and other equally broad peninsulas. What is now referred to, is, especially, the stimulant action of the sea air from its saline impregnation. It follows, that, with

some care and trouble, the degree of stimulant action that a case requires, may sometimes be secured by a location, that is nearer to or farther from the coast; the distance inland being usually greater, when the prevailing winds are strong and from the sea-ward; and less, when the elevation above the level of the coast is greater, or when the sea breezes are more or less intercepted by the intervention of higher grounds, or of woods and plantations.

The effect of the air of the sea-coast, and of insular situations generally, is much influenced by the nature of the soil, the character of the prevailing vegetation, the dryness or dampness of the atmosphere, the latitude of the place, &c. The air of the coast near the embouchures of rivers, which overflow their banks during the rainy seasons, leaving extensive marshy lands to dry in the intervals between the rains,—especially if the soil be alluvial, and the vegetation rank and abundant, and the temperature high,—must be much more destructive to health, than inland situations, which are probably on a higher level, and watered with streams of a less considerable size, and in which there is consequently less risk of extensive inundations, and of miasmatic exhalations to a correspondingly large degree.

The single circumstance of the necessary humidity of the air near the sea, independently of its equalised temperature, and its saline impregnation, must influence, to a very important extent, its effect on health and disease; and more particularly in countries characterised by long periods of drought,—the

inland atmosphere of which is necessarily and singularly dry,—the land during the long droughts being quite bare of all vegetation,—and the soil being loosened, from lack of moisture, into the condition of a fine, penetrating, and irritating dust. But, even in the districts of higher latitudes, and more uncertain and watery skies, the effect of the humidity of the air near the coast must be far from inconsiderable on some morbid conditions; and in many cases may be of important character,—as when there is a decided deficiency of secretion in the bronchial tubes, in cases of chronic pulmonary affection; and might be selected for the temporary or long-continued residence of the invalid, under such circumstances, with much chance of benefit.

The nature of the soil and the geological character of a district influence, in an important degree, its sanatory condition. Its drainage and vegetation, and the character of the air which passes over it, must be thus affected to a great extent; and the health of the population, and the effects of the air on disease, be largely influenced. Whether the surface of the district be formed principally or essentially of the primary rocks, or of mountain-limestone, or of sandstone, or of clay, or of alluvial matters, may be readily conceived to constitute influential circumstances in modifying the condition of the air, as to its dryness, and its freedom from possible sources of impurity. But, besides these more evident and explicable differences, it is probable that the surface-stratum or the surface-soil of a district may directly

influence the character of the atmosphere, to an extent favourable or otherwise to different constitutional conditions, or different states of disease. Living in a district in which the mountain-limestone very extensively prevails, it often happens to me to be assured by invalids, especially those who suffer from different forms of rheumatism, that they experience a perceptible degree of palliation of their sufferings, and at all events a perceptible improvement in their general health and feelings, when they arrive within the influence of the limestone air; and they have repeatedly assured me, they could readily distinguish the air of such a district by the smell.

In connection with this subject, the very different physical conditions, and the very different effects on health and disease, of the air of hills and that of valleys, may be fitly adverted to. The extraordinary influence of valleys on the health: an influence so much greater than could have been pre-conceived: is probably ascribable, in a great degree, to a deficiency of ventilation on the large scale, and to the comparatively stagnant and unchanged atmosphere. The effects of this on the physical condition of a population are often so great, that other means of accounting for such consequences have frequently been advanced: the true explanation appearing to be, however, that (neither the peculiar character of the water made use of by the inhabitants, nor the nature of the soil, nor the employments, nor the clothing, nor the dwellings, nor the habits of the people, helping to a satisfactory rationale of the effects, inasmuch as such effects do not extend beyond the valleys,

although such several circumstances equally obtain in the adjoining localities) the stagnant atmosphere is the single cause of a degree of morbid degeneration, that seems to be proportioned to the degree in which the air is left in such a state of quiescence. The fearful accounts of cretinism, in all the appalling detail of idiocy, demoralisation, and extreme physical wretchedness, seem to confirm this view to the fullest extent.

Besides this most influentially important condition of the air of valleys,—which may obtain to a greater or less degree, from the point at which it occasions cretinism in the worst type, to that which is not perceptibly detrimental to the health of the population,—the atmosphere of valleys is usually characterised by a somewhat higher temperature, and by a more uniform temperature, than the air of plains of the same elevation, and in the same latitude. The air of valleys is usually more humid in its character than that of the plains. This may be usefully considered, in selecting a place of residence for special cases of disordered action.

The effect of the prevailing winds that blow over a district (as to the direction from which they blow; the tract they may have passed over, more or less remotely,—such as snow-capped hills, or arid plains, or a vast ocean, and the consequent temperature, humidity, &c., of the air) is very great, not only in raising or lowering the temperature of the atmosphere, but in producing or removing mists and clouds, in diminishing or increasing the amount of the radiation from the earth, in influencing the electrical

condition of the air, and in causing, or otherwise, rains, dews, &c. All these circumstances must be more or less important and influential, according to the latitude, the exposure, the elevation, and the inland or maritime situation; and the detail of the amount of such influence must vary accordingly. In this country, the remarkable effect of different winds, on some peculiarly sensitive constitutions and morbid states,—and more particularly, the difference of effect between the east and north winds, and the west and south winds,—are sufficiently well known. Many of our pulmonary invalids are aware, from increased sense of irritation, of the wind having become easterly, although all the doors and windows may have been kept carefully closed, although the sufferer be in bed, and covered with bed-clothes, and the air of the rooms maintained at an unvarying temperature, with an accuracy duly ascertained by the thermometer. This is probably due to the greater dryness of the air that is caused by the east wind; and its consequently greater irritation of the pulmonary tissues. In some cases, as in those of rheumatism, the effect often appears to be due to a change of wind, rather than to the wind blowing from any particular quarter of the heavens; and may be ascribed, with much probability, to a sudden change in the electrical condition of the air having been thus brought about, to which the morbid condition of the system prevents it from being readily adapted.

The variations of temperature between the day and the night,—and still more, the variations between

the different seasons of the year,—have a great and undoubted influence on the health of man. This influence is, however, probably more due to the changes of temperature, &c., and the immediate effect of these on the system, than to the settled heat of the one part of the year, or the settled cold of the other part. Within the tropics generally, the seasons, instead of being those of spring, summer, autumn, and winter, are rather those of the rainy and dry seasons, which severally occur twice in the year. The periods at which the rains occur, as well as their degree and duration, vary very much in different localities. In some few situations, the total absence of rain is reported to extend over two or even three years. At a distance from the equator, the temperature is not only less high, but is more easily affected by secondary circumstances; and the difference between the temperature of summer and that of winter is very much greater,—and the extreme temperature as well as the mean temperature of the different localities present degrees of difference that are much more remarkable, than they are found to be in countries nearer to the equator. These circumstances, however, serve to make man more dependent on his own exertions,—more active and energetic in body and mind,—with better exercised endowments, and a proportionably greater energy; the obligation to battle with circumstances, serving to add to the probabilities of his life, and to contribute to its healthiness. The more variable weather and less defined seasons of the higher lati-

tudes may, moreover, serve to diminish the amount of such endemic sources of disease, as may be traceable to the drying up of inundating waters in soils that are charged with the elements of decomposed organisms. But although, as to this matter, the result of the physical condition of the country may be in favour of the inhabitants of countries in the temperate regions of the earth, the immediate and direct effect of the frequent and great alternations of temperature that happen daily and hourly in the higher latitudes, the great difference between the temperature of the different seasons, the rapid changes in the condition of the air as to dryness and humidity, must be to test somewhat severely the vital powers of the human system, to destroy a larger number of the young and less strong, and to make life struggle more frequently, and at a greater risk, with the deranged conditions consequent on the disturbed balance of the different organic processes of the economy. It may well be doubted, if,—with all the admitted and great effects of civilisation, and culture, and duly exercised minds and bodies, so notable in the inhabitants of most countries that are placed in the higher latitudes of the earth,—and the relatively long life these efforts have enabled them to attain,—life would not be of greater duration in the intertropical countries than in these, and of more healthy character: in consequence of the steadier climate, the less varying seasons, and the more uniform condition of atmosphere as to temperature and as to humidity: if the sources of endemic disease could be

removed in proportion to their greater importance, and more powerful effects, under a vertical sun.

The seasons of the year exercise a marked effect on the nature and character of the prevailing diseases in this country. Disorders of the respiratory organs are found to be most prevalent, and diseased conditions of the lungs to become worse most rapidly, in the spring; and cases of intestinal disorder or disease are found to be most prevalent, and most severe in their character, in the autumn. Cases of disordered action that are referable to disturbance of the functions of the skin, are found to obtain most generally in the summer; and those which originate in disturbance of the function of the kidneys, are found to be most prevalent in the winter. Diseases are attended with more decided pyrexia in hot seasons, and are most marked by cachectic character in cold seasons. These are, perhaps, the more important of the phenomena of disease which may be referred, either altogether or partially, to the temperature, &c., of the atmosphere, and which may be connected accordingly with the different seasons of the year; and even in health, excitement is the special characteristic of the system in warm weather, and depression equally evidenced in a colder atmosphere.

Frost—an atmospheric temperature below that at which water freezes—has an important effect on the economy of the system, whether in health or disease. It appears to diminish or destroy miasmata in a remarkable degree; it affects greatly the hygrometrical and electrical conditions of the air; and it lessens

the tendency to low and typhoid kinds of morbid action,—increasing the pyrexial character both of sporadic and epidemic disease.

The character and the amount of the vegetation of a district greatly influence its sanatory condition. However carefully and fully drained ; however little alluvial the soil ; however fully, in fact, all the secondary means of aiding its salubrity may be in operation ; a district that is largely covered with vegetation must be so far prejudicial to health,—for the double reason that the aerial currents are necessarily interfered with by it, and that a large quantity of decaying matter must be thrown off, especially at certain seasons of the year, and so far taint and damage the salubrity of the atmosphere. These deteriorating influences are much more energetic in their effects, if aided by a heavy alluvial soil, with a substratum of clay or other deficiently porous material,—by deficient drainage,—and by seasons of much wet weather, succeeded by drought. These are the very circumstances, in which the awful remittent fever of the African coast proves so destructive to human life,—in which the endemic and epidemic diseases of India, as in the vicinity of extensive jungles, are most largely fatal.

The degree to which a district is sheltered from certain winds may be beneficial or injurious to the health of the population, according to circumstances. A certain amount of protection from the colder winds in the temperate climates, if not sufficient to render the atmosphere unduly stagnant, is generally useful

to health. And, on the other hand, within the tropics, places appear to be salubrious, other things being equal, much in the proportion as the air is cooled regularly or periodically by aerial currents. The effect of the sea-breeze on some districts, and that of the land-breeze on the same or on other districts, in adding to their salubrity,—as contrasted with the sanatory character of adjoining districts, which, from the vicinity of high grounds or forests, do not enjoy the influences of such breezes,—afford important illustrations of this. Or, again, one valley, or even hill-side, sheltered from the prevailing winds, is found to be the theatre of goitre in its worst form; whilst a valley immediately adjoining to it, on the other side of the same hill, exposed to the influence of the winds, may be entirely free from this dreadful malady. In this country generally, a southern exposure, with due shelter from the north and east, with a less degree of protection from the west winds, which, although so much more prevalent, are at the same time less severe and less trying to the powers of the system,—is what should be preferred.

The drainage of a district affects very considerably the degree of its salubrity. This is particularly important at certain seasons of the year, when the maximum of moisture has been perceptibly lessened by a subsequent period of drought; or when, from great heat, or great cold, or great or frequent changes of atmospheric temperature, the powers or the equilibrium of the system are much tasked or disturbed. The improved healthiness of some of the midland

counties of England, since drainage has been attended to and practised,—and the greater insalubrity of the Roman territory, and particularly at certain times of the year, than appears to have obtained in ancient days, when its drainage was more extensive and efficient,—are striking illustrations of these facts.

That much influence is exerted on the health of the inhabitants of a district, by the character of the water with which it is supplied for their domestic uses, has been always a favourite theme of medical writers, and a subject of popular belief. The degree of this influence has been, however, much exaggerated; and much has been referred to this, which is more justly referable to the stagnant atmosphere, or the prevailing winds, or the deficiency of the drainage, &c. It is probable, that, unless in the case of the water being in a state of greater or less putridity, or of its containing a large amount of saline impregnation, or a perceptible impregnation of vegetable or animal matters, it has seldom much effect on the health of a population; and when individual systems have once become habituated to its use, the instances are rare in which it proves to be of any importance whether the water reaches the surface by passing through sand, clay, limestone, or even shale: a small quantity of iron in water not appearing to have any bad effect on the healths of those using it. To the fœtid water, which, until comparatively recent times, was furnished to our seamen, was the amount and the character of disease, that used to prevail on board the ships, to be partly ascribed; and the much

greater healthiness of the Navy in the present day,—a degree of average health, presenting so low an amount of sickness, and so low a mortality,—may be ascribed, in part, to the substitution of iron tanks for the water, instead of wooden casks; by which simple expedient, the water is said to be satisfactorily preserved in a state of purity, even during long voyages,—instead of becoming disgusting to the eye, the nose, and the palate, and necessarily depressing to the powers and detrimental to the health, of the consumers, within a few weeks of its being received on board the ships.*

It may be reasonably doubted, then, whether cretinism, goitre, and the enlargement of the same gland which is often met with in some parts of Derbyshire, and known as the Derbyshire throat: all but different degrees of the same complaint,—and proofs of a deranged condition of the system, and a localised cachexia, in different degrees; although these conditions used to be referred so commonly to the internal use of water charged with particular impregnations, are ever justifiably referable to this. These proofs of morbid degeneration are rarely if ever met with in circumstances where the more important condition of an unduly stagnant atmosphere does not prevail. It may be doubted, whether the prevalence of calculous diseases in the more exposed parts of the eastern side of England and Scotland, especially the counties of Norfolk and

* Statistical Report on the Health of the Navy, 1840.

Aberdeen, which used to be referred in greater or less degree to the character of the water made use of by the people, is not entirely independent of this circumstance, and to be ascribed to peculiarities of diet: the very large use of wheaten flour in the form of dumplings in the one case, and the equally large use of oatmeal in the other case; connecting, as we may do justifiably, with this predisponent to saline and azotised accumulations, the degree of interference with the functions of the skin, and the degree of extraordinary and irregular duty devolved upon the kidneys, which must result from so much exposure to the direct and untempered and unsheltered influence of the easterly winds, that have blown over the German Ocean, having been previously chilled by crossing the colder countries of the north of Europe.

It is not, indeed, to be denied, that, in the instance of people removing from one locality to another, the internal use of water with a very different character or amount of mineral impregnation may for a time influence the system very considerably; and this may well be the case, in a remarkable degree, in the instance of the invalided. Living in a limestone district, much resorted to by invalided visitors, it used to happen to me very frequently to find that such sojourners were influenced, and their systems disturbed to an important degree, by the use of the calcareous water of the mountain limestone formation,—carefully distinguishing this, as it is right to do, from the thermal mineral water of Buxton, containing other than simply calcareous

matters in solution. In later years, Buxton has been more extensively and effectually supplied with a pure gritstone water, derived from an adjoining formation, for domestic purposes. In the case of the resident population, I am not aware that any modification of deranged health is traceable to the use of any of the very differently impregnated waters in this extensive district, nor that any degree of immunity from any form of morbid action can be referred to such circumstance; and, inasmuch as the different springs in the vicinity percolate sandstone, limestone, and shale, or the water made use of is derived directly from the rain, this may be admitted to be worthy of mention.

In general, and more particularly in the towns, the importance attaches rather to the quantity of water for domestic uses with which a district is supplied, than to the character of its mineral impregnation. Sufficiently good water, for all the purposes of the economy of the system, is found in most of the towns of this country; but an abundant supply of water,—so abundant as to answer all the sanitary purposes which such a supply may subserve,—is by no means so common. Yet this is a primary question,—bearing extensively on the public health, and which should be early and fully attended to. Such a supply should be secured,—and could be easily secured, in any conceivable case,—as would serve not only to answer all domestic purposes, whether for internal, or culinary, or other household uses, but such a quantity as will serve to carry away, fully and

promptly, all possible sources of impurity out of the dwellings, and either convey them to some neighbouring stream, or so dispose of them as to place them beyond the chance of influencing the atmospheric condition of the town or its neighbourhood. This would include such a supply of water, as would serve to cleanse the streets as well as the interiors of the houses, wherever this might appear to be necessary; and by permitting the sewers to be filled or flushed with water at longer or shorter intervals of time, would suffice for the removal of any source of impurity that might be collected either at the corners of drains, or in their smaller branches, or when, from an unavoidably deficient degree of fall, it might prove to be impossible to keep them clear otherwise.

The effect of existing animal or insect life on the health has been a more curious subject of inquiry of late years, from the revival of an ancient idea that some of the endemic and epidemic diseases—the epidemic cholera, for instance—may be propagated or spread by means of insects, and even conveyed from and to places far apart from one another. The idea is not wanting in curious interest; and it has been advanced from time to time with plausible confirmatory circumstances, and supported with considerable ingenuity. But it is altogether an unproved and merely speculative question, from which no justifiable deductions can be drawn. The effect of insects in the intertropical countries, both during life by their numbers, their rapacity, or their venomous

character, and after death by their effluvia, appears to be sometimes of importance.

Such are some of the principal circumstances which affect the question of climate, and determine its salubrity or otherwise. The deductions from them in individual instances must be governed and modified by the various circumstances of different localities, as well as by the conditions of the system, as to health or disease, which may be under review. Such a practical acquaintance with the sanatory character of any locality can only be obtained by means of extensive data, the result of observations continued during several successive years, as to its mean temperature,—its daily maximum and minimum temperature,—the variation in the temperature of the day and the night,—the quantity of rain which falls during the year, and the times at which it falls,—in addition to all the other physical circumstances that have been noticed above, duly and fully ascertained. Furthermore, such a medical history of a district or country should include sufficiently extensive tabular digests of the prevailing diseases, and their individual fatality; such tables specifying, moreover, the total average mortality in reference to the amount of the population,—the observations being extended over many years. Of such conclusively full and satisfactory accounts, there are as yet few from any parts of the world; and until these are sufficiently general to supply the materials for comparison and inference, the subject of climate must be incomplete in its practical detail.

The ascertained principles show why, from its

comparatively peninsular character, bounded on one side by the Mediterranean, on the other by the Atlantic, the winter climate of the greater part of Europe should be less severely cold, and the summer heats less excessive, than is found to be the case in such parts of the interiors of the large continents as are in the same latitude. The same great principles would go far to determine, without further local data, that one place would be warmer, or have a more equable temperature, or be subject to a less average fall of rain, or be liable to less heavy periodical rains, or enjoy a drier soil; and many other similar and equally important questions might be answered, by merely surveying the general features and circumstances of a country with the eye of a geologist and a physician,—even including the probable liabilities to endemic disease, and its general character. But the confirmation and extension of such observation, by statistical details of the prevailing diseases, their average mortality, &c., would be nevertheless of no small value and interest. How often are the phthisical invalids sent to districts, where phthisis is even more prevalent than it is in the places they have been sent away from,—with the probable result of accelerating instead of deferring the death,—and the certain result of exposing the poor invalid to much fatigue and inconvenience, without there being any chance of benefit accruing therefrom! How often are families found to spend the autumnal months, by way of obtaining a change of air and of benefiting their healths, in places peculiarly remarkable for the

existence of a defective drainage, or other sources of miasmatic impurity; the denizens being liable, in a corresponding degree, to disorders of the stomach and bowels, which it is so important to avoid as much as possible at that period of the year, and from which persons that are unaccustomed to a locality are so peculiarly liable to suffer! How often are serofulous cases sent to districts where the disease is particularly rife, and the risk of aggravation to the cases of the sojourners is proportionably great, and the chance of the change of air having any good effect is in the same proportion small! Satisfactory details as to the prevailing diseases, and their relative mortality in the different parts of England, may now be referred to in the valuable Reports of the Registrar-General. Similar accounts, of much importance in authoritative interest, are given in the Reports on the health of the seamen of the British Navy, and of the soldiers employed at the different stations and dependencies of this country, in different latitudes, and on the health of the troops employed in the home-service. And although the deductions from these Reports might seem to be of somewhat less value, inasmuch as they are founded on the condition of men who are leading a life of peculiar occupation, habits, &c., and who are for the most part of a selected physical standard, and in the prime of life, yet the comparison of the results obtained from the military and naval records, with those derived from returns embracing the general population, may be fairly said to increase the value and

importance of such records individually. But these accounts are too few to furnish data for conclusions respecting the sanatory character of more than a few places or countries in the world.

In most cases, in the instance of the invalided, if a removal from their own district be needful, the question of the kind of air they should endeavour to obtain by the removal may be determined, without much difficulty, by giving due attention to the nature of the disease, the function of the affected organ in relation to those of the general system, the temperament and habit of body of the individual, &c.; and thus, the great consideration as to whether a drier or a moister air, a cooler or warmer air, a more quickly changed or more stagnant air, a thinner or denser air, an inland or a saline atmosphere, may be readily, or without much difficulty, determined; and the difficulty of selection may be by so much narrowed and diminished, in an important degree.

Usually, pastoral districts are, for obvious reasons, and in all cases, to be preferred to arable districts of country, for the temporary or the permanent residence of the invalided.

As to England, if a locality the atmosphere of which is of mild but damp character is sought for, the best situations are to be found in Devonshire, and Torquay especially deserves to be mentioned; the mildest peninsular climate seems to be that of Penzance; the best maritime climates are found in the Isle of Wight, Jersey, Guernsey, and the Isle of Man, —respectively deserving a preference, in proportion

as greater warmth may be necessary, or a moderately free exposure to cold and wind is not considered to be objectionable. The best mountain climates are to be found in the more sheltered uplands of Wales, and in the High Peak of Derbyshire; and these districts offer a climate that is often peculiarly suitable to the summer residence of invalids.

But, in England, in the summer months, there is no deficiency of choice as to invalid places of residence; and even some of the elevated districts of Scotland may offer advantages to some cases. In more delicate cases, where so stimulating and bracing an atmosphere, as the higher elevations or more northerly localities necessarily involve, would be objectionable even for the residence during summer, the hills of Malvern, or such less elevated but still comparatively high ground as is to be found in so many of the English counties, might be preferred. In other cases, the air of the sea-coast might be most useful,—selecting the exposure of the coast according to the nature of the case; from the colder and drier north-west coast, stretching from the Mersey to the Solway, and including Blackpool and Fleetwood, and the many smaller marine watering places near Liverpool,—to the somewhat less dry north-east coast, extending from Berwick to the Humber, embracing Scarborough, &c.; or from this to the warmer coasts of Suffolk and Essex, adding Margate thereto as having the same exposure; or from this to the still warmer south coast, which is conveniently divided into the south-eastern, from

Dover to the Isle of Wight inclusive,—the southern, from Weymouth to the Land's End inclusive,—and the south-western, from beyond the peninsula of Cornwall to Milford Haven, embracing all the sea-coast of the Bristol Channel, and the different places on the banks of the Severn. It may prove to be a considerable convenience, and not lead to any serious error, to assume that these divisions of the coast of England are so many landmarks of milder and milder coast climate for the residence of invalids; from the coasts of Lancashire and Cumberland, to those of Northumberland, Durham, and Yorkshire,—from these, to the Suffolk and Essex coasts,—from these, to the coasts of Kent, Sussex, and Hampshire,—from these, to the coast of Dorset, and the south-coast of Devonshire, and the whole of the Cornish coast,—and from these, to the coast washed by the Bristol Channel and the Mouth of the Severn. The Welsh coast, occupying the remaining sea-wall of England, including Milford Haven, and Cardigan and Carnarvon Bays, occupies a place midway in situation and character between the Lancashire and the Cornish coasts.

In the summer and autumnal months, perhaps none of these may be decidedly objectionable for the residence of the majority of invalids, to whom a sea-side residence may be recommended; but in the winter and spring months, the coasts of Cornwall, Devon, and Dorset, should be chiefly and perhaps exclusively selected, with the exception of Hastings, and of some few places of less importance; unless in

eases where a damp atmosphere, even of saline character, appears to be less suitable than a colder and drier air, in which cases some of the other parts of the coast may be justifiably preferred. In the later autumnal and early winter months, the coast of Sussex (Brighton) may be strongly recommended. The Isle of Wight affords several sheltered and suitable localities for the winter residence of invalids. In the spring months, the sea-coast is for the most part wisely avoided, in these high latitudes; and the sheltered inland situations should be generally preferred, even in cases where the air of the sea-coast seems to be most advisable at other times of the year. The most eligible of these situations are to be found in the inland parts of Devonshire; and next to these, Clifton, Bath, Cheltenham, and perhaps even the vicinity of London, may be fitly classed. As regards the north of England, there is less choice and more difficulty, in finding desirable localities for the winter residence of the invalided. Some parts of Cheshire, and Matlock in Derbyshire, are the most valued of these; and to these places may be added, generally, such situations as are at once the best sheltered and the most dry, from the circumstances of soil and elevation, and which are situated, as nearly as may be, midway between the eastern and western coasts.

The whole of the south and south-west coast of England, however, even in cases where the climate proves to be sufficiently mild and temperate for the invalid's residence during the winter and spring months, is generally much too humid for many of them.

The same remark applies even to the long-praised and highly-famed climate of the south of France. On the south-west of France, the provinces of Gascony and Bearn comprise the principal places resorted to by invalids; Pau being the chief of these. According to Sir James Clark, whose work on climate is so well known,* Pau appears to be chiefly remarkable and valuable for the residence of invalids during the spring months, on account of the mildness of the temperature; being warmer than London, or even than Penzance, and but little colder than Rome. It is likewise reported to have a dry soil; and it is said that its northerly winds are less trying to invalids, than those winds are apt to be in this country during the spring months. It has the fault of unsteadiness of temperature; while it has the great advantage of being near to the watering-places of the Higher Pyrenees, which present a delightful summer climate to the invalid. The south-east of France,—consisting of the provinces of Languedoc and Provence, including Montpelier, Marseilles, and Hyères,—to which, although situated in Piedmont, Nice may be added,—is warmer and drier than the south-western district; but is objectionable from its greater vicissitudes of temperature, and the frequency of harsh and cold winds. A system should be in a condition to bear a stimulating and bracing atmosphere, that is sent to pass the winter and spring in this part of France. These remarks are chiefly applicable to Montpelier

* The Sanative Influence of Climate. By Sir James Clark, Bart. M.D., F.R.S., &c.

and Marseilles. Hyères is protected considerably from the piercing north winds, by the range of hills at the base of which it is situated; and it appears to be by so much, and to a great degree, less objectionable on this account. As regards Nice, too, there is protection from the north by steep and lofty mountains; but the winds are said to be cold; and the air, although mild and somewhat soft, is rather exciting. It is too hot as a summer residence for most invalids.

The climate of Italy affords much greater advantages to invalids, than that of the South of France. It is less dry, but proportionally more soft and less exciting. In cases where the excitability and morbid sensitiveness of the tissues are considerable,—so often primary indications in the case of the pulmonary invalid,—this may be the best and strongest of all recommendations. Pisa, Rome, and Naples are the places in highest consideration, and chiefly resorted to by the invalids from this country. Pisa is in the highest estimation when the invalid requires shelter, and will not bear exertion; and Rome seems to be preferable under other circumstances. Naples is considered to be more exciting than either Pisa or Rome: its air has more of a sea-coast character, and it is more subject to winds than Pisa. The whole of the south-west of Italy, from Genoa to Sicily, is probably possessed of important and sufficiently different physical advantages, as winter or spring climates for invalids, to be worthy of a full and satisfactory statistical inquiry, as to temperature, winds, rain, prevailing diseases, &c.

Of information as to the climate of the more

important localities in the Mediterranean, the admirable medical topography of Dr. Hennen, and the very able Army Medical Reports, leave little to be wished for. The accounts include Gibraltar, Malta, and the Ionian Islands; and show a climate that is, on the average of the whole year, warm and dry; subject, however, to fogs and cold winds, and therefore not so well suited for the winter or spring residence of invalids, as might have been expected. In Gibraltar we find that the temperature in summer reaches to 91° , the lowest temperature in winter being 50° ; and that the average number of days on which rain falls during the year is only 70, the number of days on which rain falls annually in London being stated at 178. Yet, owing to the easterly winds, which are damp, raw, and unpleasant, all the advantages of climate presented by Gibraltar are neutralised, so far as the interests and comforts of the invalided are concerned. The heat of Gibraltar would be too great in summer for invalid residence; and the dense fogs of the autumn, the heavy rains of September and October, the prevalence of easterly winds during an average of 184 days in the year, all multiply conclusive objections to this ever being selected as a residence for the invalided. Among the resident population, the average mortality appears to differ very little from that of the United Kingdom.

The climate of Malta is affected by the scanty vegetable covering of its soft rocky soil; causing the atmosphere to be charged with an impalpable dust that must be injurious to the pulmonary invalid. Besides

this, the climate is affected by the hot winds, which come to it after having swept over the deserts of Africa, and the sandy coast of Egypt and Syria; and its temperature, and particularly its summer temperature, is proportionally high. In the summer, indeed, the heat is little less than that of the tropics; ranging from a minimum of $69\frac{1}{2}^{\circ}$ to a maximum of 86° during the months of June, July, August, and September. It is subject to rains of tropical violence, from October to February; and the air is surcharged with moisture till March: when all the damp and wet of winter are largely atoned for to the healthy resident, by a succeeding five months, in which the sky is virtually cloudless, and scarcely a drop of rain falls. The south-east wind is the most common and the most disagreeable in its effects; and the absence of a regular land and sea breeze,—so useful and grateful in most tropical countries, by tempering the sultry heats,—must necessitate a great deduction from the sanatory character of the Maltese climate. Long considered to be salubrious to its inhabitants, and those who sojourn there in a state of health,—and as it used to be thought, even advantageous to the phthisical invalid resorting to it,—Malta seems, on the high authority of the Army Reports, to have the average annual mortality of 1 in 39; the average yearly mortality of England having been only 1 in $47\frac{1}{3}$ during the same years. The salubrity of the climate of Malta is computed, on the whole, to be neither higher nor lower in its degree, than that of the Southern States of Europe generally,—of which the

mean annual mortality is stated to be, from 1 in 35 to 1 in 40 of the population. The troops are said to have suffered more from fever in Malta than in Gibraltar, and twice as much as the troops at home; and more than one-third of the deaths is referred to diseases of the lungs. The inhabitants appear to suffer as much from pulmonary disease, as those of more northern latitudes; and the troops were attacked with fatal disease of the lungs, in even a somewhat larger proportion than has been reported to obtain in this country. The mortality among the native troops, called the Malta Fencibles, seems to have been less than half the mortality of the troops of the line—natives of Britain; and this circumstance furnishes a strong caution against inconsiderately sending the invalided to climates that are very different to that of their native country,—on account of the greater mortality that must, under almost any conceivable circumstances, in this way be risked.

The Ionian Islands, remarkable for the luxuriance and abundant growth of the Olive, and so suited to the cultivation of the small seedless variety of grape, familiar as the so-called dried currant of commerce,—have a summer temperature that ranges from 77° to 84° , and a temperature in the winter months of from 49° to 58° . They are subject, from their mountainous character, to sudden atmospherical changes; the extremes of heat and cold, drought and damp, tempest and calm, often succeeding one another in course of a few hours. The degree of heat and the

whole character of the atmosphere in these islands are remarkably influenced by the direction of the wind. Here, the north and north-east winds are said to be cool; in other parts of the Mediterranean, they are described as chilling and piercingly harsh,—coming from snow-clad mountains upon the previously heated air, and suddenly bringing it down to a wintry character. But, however grateful the northerly winds are in the Ionian Islands, the south wind is here, as elsewhere in the Mediterranean, characterised by the burning sands of Africa—often bringing with it mists and rain—and sometimes having the stifling and depressing character, known as the Sirocco wind, which withers vegetation, causes the beasts of the field to droop, and subjects man to a sense of exhaustion, that is to be compared in its degree to nothing but the effect produced on the sensitive few in this country by extreme electrical changes: this is only relievable by a change of wind. As far as the health of the British troops is a guide to the sanatory character of the Ionian Islands, the conclusions must be highly unfavourable. Compared with Malta, the deaths are given, in round numbers, as 28 to 18,—and with Gibraltar, as 28 to 22. Among the natives, however, the average mortality is only stated as 1 in 39: the same proportion as that of Malta, and indeed probably but little different from that of the South of Europe generally. One half of the mortality is stated to be from fever, which affords a convincing indication of how much might be done to diminish the average fatality of these islands. Of

the remaining deaths, nearly one half is referred to diseases of the lungs; and of these, almost two-thirds are set down as cases of consumption.

Bearing the above facts in mind,—and coupling with them the physical characters of the Mediterranean climate,—and, further than any good effect from change of air and change of scenc, it appears that little advantage is offered by the climates of Southern Europe to any class of invalids, and least of all to pulmonary invalids. The mortality from consumption among the troops was found to be generally greater than that in England; and must be at least fully as high, making every allowance for possible sources of error. Curiously enough, indeed, the mortality from phthisis appears to have been greater among the troops in the Mediterranean climates, than in North America; notwithstanding the frequent exposure of the soldier employed in the latter service to the air in the night, when the temperature is below the zero of Fahrenheit's scale. But frequent and great alternations of temperature, such as obtain so generally throughout Southern Europe, —the influence of the Sirocco,—and the considerable heats of summer,—all tend to induce and keep up a state of system, that may well be believed to predispose to or increase pulmonary delicacy; and can hardly be supposed, unless under very unusual circumstances, to lessen the disposition to phthisis, or prolong the existence of those already labouring under the disease.

Passing from the Mediterranean, and its so long

misunderstood and over-estimated climatorial characters, the climate of Egypt, as reported by many intelligent and competent observers, demands some notice, on account of its extreme dryness. The great heats of the Egyptian summer must be too much for the cases of most invalids. In the winter months, however, the thermometer is said to average 70 degrees, and to be never seen below 40°; and at that time of the year, even the southerly winds are said to have a cooling influence; and the northerly and westerly winds are at all times characterised by an agreeable freshness to the feelings. In the months of December, January, and February, there can be little doubt that many an invalid would find advantage in the climate of Egypt; and in those cases in which a dry climate seems to be the great physical desideratum,—and such cases are sufficiently numerous,—by care in the selection of the locality, it is not improbable that a residence in Egypt, even throughout the year, might be eminently useful. The effect of the sultry and depressing south wind, with the lurid sky, on the one hand,—and the alternations of this with the cooling north and west winds; the steamy vapours from the inundations of the Nile, affecting, as they must do, extensive districts of the country, and only prevented from producing a marshy surface and leading to miasmatic exhalations, by the extremely arid nature of the soil; the intense heat of the long summer, with its great effect on the cutaneous functions; should be, severally, and collectively, and fully considered, with their probable

influence on the constitution and the disease, before the great step of removing to such a climate is ventured upon. The peculiar effect of the climate of Egypt upon the eyes,—whether from the dusty air, or the intense light of the sun, or the scorching winds, or the mere dryness of the atmosphere; the liability of the natives to certain severe diseases of the skin and cellular tissue; are important features in its medical history,—but perhaps of little importance to invalids resorting to it for temporary sojourn. The endemic diseases (chiefly dysentery) appear to be exclusively owing to the uncleansed state of the towns, and the dirty habits of many of the people. The frequency of hepatitis among the resident population,—probably connected in a great degree with the high temperature of the country,—is likewise hardly of primary importance to the invalided sojourner. As to the Plague,—and perhaps the remark may apply to some of the other diseases that have been adverted to,—an energetic Executive has done much to remove what is nothing less than an opprobrium on the information, diligence, and common sense, of any Government; dependent as most epidemic and endemic diseases are on removable circumstances, that can be, and ought always to be, dealt with summarily.

It is difficult, in these days of advancing commercial relations and intercourse among the nations of the world,—and increasing means, rapidity, and safety of locomotion, both by land and by water,—to conceive what climate or country of the world, however remote,

and however hitherto considered to be inaccessible, might not be interesting to the invalid, for the advantages offered to his morbid conditions, by its physical circumstances, and the character of its climate. The Himalayas or the Nielgherries might eventually not seem to be too remote or too inaccessible for the removal and sojourn of the sufferer from chronic disease; and even some parts of the vast Empire of China may hereafter offer strong and sufficiently tempting advantages; but, in the meantime, it may be enough to add to what has been said, that the great American continents present few climatorial advantages to the invalid,—whether the extreme coldness of the Canadian winter,—or the remarkable differences between the summer and winter temperature throughout the greater part of the Americas,—or the influence of uncleared forest, or extensive prairie, or vast lakes, or great inland salt marshes, or whole districts charged with decomposing vegetable matters with their miasmatic exhalations,—or the influence of violent thunder storms,—be considered; connecting therewith the prevalence of fever, or of other forms of equally grave disease, in the different localities of the New World. Whether the heats of the Carolinas, the West Indies, and a large part of the South American continent be considered, together with the many sources they present of endemic disease,—or the above-cited broad facts be fairly brought under review,—it is difficult to conceive that the invalided, under any circumstances that commonly obtain, would find sufficient physical advantages in

such extreme climates, to tempt them to wander so far, even in search of health. This is still more true in regard to the African continent, with its burning sun and arid soil; and these vast regions may be fairly considered to be beyond my present purpose. I shall notice, in detail, only one more place, as important on account of the physical advantages which it offers for the sojourn of invalids.

Situated in the Northern Atlantic, Madeira may be classed with many other similarly detached islands; which are far removed from the influence of extensive continents, and enjoy a warm but tempered climate; the heats of summer being moderated, and the winter temperature being equalised, by the influences of the ocean: by its temperature, its currents, and its winds. Situated in latitude $32^{\circ} 30'$ north, its climate is proportionably warmer than that of Europe; while its insular position keeps the variations of temperature within 14 degrees: a range which is far less than obtains in the most favoured country or district of Europe; permitting its summer temperature to be a few degrees cooler, and its winter temperature to be twelve degrees warmer, than that of any part of Italy or France. The rains, too, fall chiefly in the autumn; and the average number of days on which rain falls, is stated to be only 73; whereas rain is said to fall, on the average of years, on no fewer than 117 days at Rome, on 146 days in the Isle of Wight, and on 178 days in London. The mean annual temperature of Funchal, the capital of Madeira, is stated to be 65° ; that of Rome being $60^{\circ} 70'$, and that of London being

50° 39'. When it is added, that the air, although dry, is so nearly at the point of saturation, as to render it as far as possible soothing in its effects on the air-passages, and so far well fitted for eases of pulmonary irritation,—that, in consequence of the regular sea-breezes, the air, even in the summer-time, is rarely oppressive, or even close or sultry,—that there is neither smoke nor dust to render the air impure,—that the thermometer, even at sunrise, is rarely found to be below 50°,—that the native peasantry, although hard worked and badly fed, are healthy and robust, exempted from intermittent and remittent fevers, continued fever being of rare occurrence, and tubercular consumption being a rare disease, in comparison with what obtains in more northern climates,—it is little surprising that so many should be advised every year to risk the fatigues of the voyage by sea, leave all the home-comforts and home-blessings so far behind them, and consent to sojourn in a country where the roads are impassable for wheeled carriages, and exercise can only be taken out of doors on foot, or mounted on the small horses of the country.

The subject of climate, even so far as the selection of a place of residence or sojourn for the invalided, is felt to be far from exhausted in the above observations ; and the broad details of the medical history of the different countries of the world, and their several influences on the health and life of mankind, are still less fully considered. The reader is referred, however, with much confidence, to the work by Sir James Clark, already mentioned,—and more especially to

the admirable tables of the mean temperatures, &c., of different places, that are given in that work ; and Dr. Hennen's work, and the Reports on the Health of the Army and Navy, supply ample and satisfactory information, as to the sanatory character of the South of Europe, North America, the West Indies, &c.

The subject of climate appears to lead very naturally to that of *change of air*: one of the most important and most useful of remedial agents.

A man can scarcely be in a state of such perfect health, as not to be benefited by change of air. Indeed, an occasional change of air may be said to be almost necessary to the perfect well-being of every man. The workman must leave his workshop, the student his library, and the lawyer his office, or, sooner or later, his health will pay the penalty ; and this, no matter how great his temperance in eating and drinking,—no matter how vigorously and regularly he uses his limbs,—no matter how open, and dry, and free from sources of impurity, may be the air of the place in which he is employed.

The change of air may or may not be so great as to be virtually a change of climate, according to the circumstances or the necessities of the case ; and it may or may not involve the removal of an individual from his usual occupations and pursuits for the time,—substituting a comparative relaxation of mind and body,—or at least a change of direction and effort. In the slighter cases of impaired health, the sleeping in the suburbs of the town in which the life is chiefly spent, or even the spending a few hours of detached days in

some accessible rural district, at a few miles distance from the dwelling, may suffice to restore the healthy balance of the bodily functions, and maintain the bodily machine in a fit state for its duties; or in cases of somewhat more urgency, or of somewhat more aggravated character, a more decided change of air, for even a few days, once or twice a year, may suffice to adjust or restore the due economy of the system.

The degree of the change of air, or the character of the air selected for the purpose, may be by no means adapted, however, to the degree or the nature of the case, and may deserve and require a careful consideration. The degree of the change of air,—the difference of character between the air to which the system has been habituated, and that of the place selected for the temporary abode,—may be too great, or not great enough: it may be so great as to stimulate unduly, or so great as to relax in an unwise degree, or not sufficiently great to exercise any beneficial effect whatever on the nature of the case, further than the change of scene, and the mental stimulus of such change, may necessarily involve. It may generally hold true, that the change should be to a purer or a more stimulating atmosphere in the slighter cases of indisposition, and to a more relaxing air in the more severe cases of illness; but it would be found to be a rule that is subject to a very large number of exceptions. The man labouring under indigestion, that is the effect of sedentary habits and repletion, would be probably injured by a removal to a warmer and moister air than that to

which he had been accustomed, but would be benefited by a change to an air colder and drier than his own. The irritable sufferer from dyspepsia, the result of deficiency of proper nourishment, or of powers too languid to convert his food into blood, would probably suffer an aggravation of his ailments by a removal to a colder and drier air, and be restored to health by a change to one warmer and more moist. In proportion to the weakness, the irritability, the sensitiveness to every impression, ought the change to be to an air that is softer and warmer. In proportion to the strength of the body, the lethargic state of its powers, the dulled condition of its sensations, ought the change to be to an air which is drier and more cold. There are states of highly irritable system, in which almost every kind of food is felt by the stomach, and gives it uneasiness; or in which a little dust floating in a room produces a fit of coughing; or in which breathing a colder air than usual produces the same effect,—the cough being dry and almost *tinkling*; or in which the gentlest aperient medicine produces pain, and, perhaps, diarrhoea; or in which the most common domestic occurrence vexes and annoys. Any such state will probably derive advantage from a mild, soft air; and would probably be injured by an air of a different kind. There is a state of system in which there are excessive languor and relaxation; in which the stomach, so far from feeling almost any kind of food, is hardly roused into action by spirits or condiments; in which a strong cathartic medicine scarcely produces an

uneasy feeling ; in which severe domestic trials hardly produce a temporary impression ; in which secretion may be free ; in which, if there is cough, it is commonly loose and unirritating. Such a case would be probably injured by the relaxing effects of a soft warm air, but derive benefit from an air at once dry and somewhat cold.

The degree of the change of air that is required and indicated is of little less importance than the due selection of the kind of air best suited to the nature of the case. In general, likewise, more or less of a marked difference in the character of the air should be considered to be necessary ; and the inhabitant of an inland district might advantageously, under most circumstances, have some part of the coast selected for the change of air ; or the dweller in a low or flat country, seek some upland, or possibly mountain district ; or the inhabitant of an alluvial, or a chalk, or a sandstone, or a mountain-limestone district, might more advantageously remove to a district of a different formation. Nevertheless, this question might be properly made subservient to the more important question—whether the nature of the case indicates a removal to a more relaxing or a more stimulating atmosphere.

Change of air, to be of service, should be well timed ; and should, if possible, be obtained in an early period of a chronic and lingering disease ; and not be deferred longer than can be avoided, in convalescence from active or inflammatory affections.

The more impure the air to which the person has

been accustomed, the more cautious and deliberative should be the change of air and its degree, but the more imperatively is such change of air called for. The younger the person, the greater the benefit to be derived from a change of air; and the more necessary and advisable is such change usually found to be. It would be generally well, when a man becomes affected with a disturbed state of his digestive or biliary organs, if such state should not speedily yield to a regulated diet, and exercise, and the usual medicaments, that days and weeks should not be consumed, and indeed wasted, in trying this thing or that thing, or trusting to the beneficence of nature, or to the *strength* of his constitution; but that an early trial should be given of a *judicious* change of air. It would be generally well, when a man becomes affected with some degree of dyspnœa, cough, and other indications of an irritable state of the respiratory organs, if, as soon as the urgent symptoms had been relieved,—or, *better still*, if they should not have as yet come on,—the effect of a wisely selected change of air were early and timely tried. How often, in cases of this kind, have delays been proved to have been not only dangerous, but fatal! There is not a fact in the whole range of pathology, that is more pregnant with sound matter for practical reflection than this: that at no time is a man more apt to contract structural disease, than immediately after the subsidence of active disorder, during the debilitated convalescence. A *judicious* change of air, as a means of accelerating the restora-

tion to health, as a means of lessening this risk, is invaluable; and where it can be accomplished, should be never neglected.

The *young*, whether well or ill in the broad sense of the words, are always advantaged by change of air. If brought up in a large town, an occasional change to the air of the country is almost necessary to give them strength and sound health. After illness, change of air is almost necessary to the young convalescent. It cannot be doubted, that many children fall into permanent and incurable disease, who might be restored to health if a judicious and timely change of air could be obtained for them.

The change of air, which, in cases of *comparative* health, I would advise in strongest terms, is that embraced in constantly moving for the time from place to place,—taking as much personal exercise during the journey as is found to be possible. I have often been struck with the fact, that an Englishman will readily make up his mind to set off to the Continent; go among a people whose language he is perhaps quite ignorant of,—whose habits are quite foreign to his own,—whose houses, except in the larger cities, may be such as to disgust his insular love and sense of cleanliness,—whose style of living may be such as to make him almost loathe the sight of food,*—whose country may or may not admit of

* If it be read with some little allowance for love of country, and ardor scribendi, the following furnishes an apt illustration of this part of the text:—"Among the 'miseries of human life' might be ranked that of dining, or rather starving, at a German *table d'hôte*—and that,

but an indifferent comparison with his own; and he may, at a considerable expense, have transported himself thither. And for what purpose? Perhaps, to set out on a pedestrian tour, with a stick and a

too, in the midst of plenty! It is in such a place that the paradox is explained—‘inopem me copia fecit.’ Sir F. Head too has remarked that ‘the dish that is not acid is sure to be oily.’ If this were all, we should have small reason to complain. The misfortune is, that not only oils and acids are liberally distributed by that infernal agent, the *Maitre de Cuisine*, but every loathsome ingredient that the three kingdoms of nature can furnish is crammed into every pot and sauce-pan in his subterranean dominions. Some philosophers have endeavoured to distinguish man from other animals, and elevate him on the scale of created beings, on account of his *cooking* propensities. I think they entitle him to an additional seven years in *Purgatory*, if there be such a place, as our Catholic brethren affirm there is! One thing is clear, however, that he is punished here below for the crimes which he commits against nature, by ‘torturing dishes from their native taste,’ and mingling all unutterable things in that box of Pandora—his accursed culinary cauldron!

“The succession is not less abhorrent to the English palate than the composition of continental dishes. It is generally believed that animal and vegetable food is designed to be eaten together, otherwise nature would have furnished one side of the mouth with incisors and the other with grinders. In the ‘continental system,’ they take a very different view of things. When the vegetables (rather less than half-boiled, and swimming in oil) are on the table, there is no animal food—none, at least, that has not undergone more transubstantiations than Vishnou, and more metamorphoses than are recorded by Ovid. When meat smokes on the board, the vegetables have disappeared! The animal that was browsing or bleating on the mountains the preceding day, and slaughtered in the night, is burnt to a cinder, or boiled till little more than bones and sinews are left:—in either case it is some degrees harder and tougher than well tanned sole-leather. As for poor Chanticleer, his ablation from the roost, decapitation in the court-yard, *auto da fé* in the kitchen, dissection in the *salle à manger*, and sepulture in some dark recess of a German stomach, occupy about three-quarters of an hour—the five acts of the tragedy being often enacted *after* the soup has gone its round of the *table d’hôte*!”—From Dr. James Johnson’s account of “*The Baths of Pfeffers*.”

bundle,—an undertaking which he might have performed at home, more cheaply, as improvingly, with many and evident greater advantages, and probably with as much benefit to his health; or he may have done this for the sake of bathing in thermal springs, which are probably not better suited to his ease than those of Buxton or Bath,—or in order to drink saline mineral waters that are possibly not equal to those of Cheltenham, or chalybeate waters not better than those of Tunbridge Wells, or sulphuretted waters not comparable to those of Harrogate. It may be very well to say to the man of wealth and independence, “Medicine is really not calculated to effect your cure. Get together your travelling conveniences, your carriage, and your servants,—and go to the Continent, and visit the ‘Brunnens of Nassau,’ or the Tyrol, or the South of France, or Rome, or Naples.” But this sort of advice, if given to the great mass of the people of Great Britain, even of the middle classes, is only like filling their hands with water, which, thirsty though they be, is never likely to reach their lips,—or, suspending viands before their eyes, which are destined for ever to elude their famishing and eager grasp. It may be said to such, with sufficient truth, that they have little cause to envy their wealthier brethren the unbounded freedom of far and wide migration;—that, to taste all the pleasures which the best and most health-giving of all kinds of travelling affords, they need not to leave their native land; but, with some shillings or pounds, according to their means and their

expectations, and a bundle, containing a change or two of linen, and an extra pair of shoes, hung over the shoulder by a stick, they may wander over the Highlands of Scotland, over Cumberland, or Westmorland, or Wales, or last, but not least, Derbyshire; and admiring the beauties of the woods and plains, or the grandeur of unequalled or unsurpassed mountain scenery,—warmed into a taste for the sublime and the beautiful, by seeing Nature in all her inimitable, unartificial, and untouched grandeur, and by seeing her decorated, and made more useful, by the hand of man,—they may, after a ramble of weeks or months, as may be, return home with the assured conviction, that what travelling and change of air and scene can do for man's health, they have done for theirs.

It is this sort of travelling; this total removal from ordinary and every day habits; this constant exercise; this continual change of air; which does most good; that, if the man is in moderate health, is calculated to give vigour to his system, freedom to his limbs, and clearness to his mind; that has, like magic, uprooted many a case of long continued dyspepsia, and caused many a case of chronic disordered action, threatening to degenerate into something worse, to be no longer felt.

Change of air may be too great; but it cannot be too frequent, if the powers of the system are not materially impaired.

In many, the majority of the cases of indigestion,

the spirits are either very much depressed, or the mind is in a state of highly morbid excitability. There are few diseases, in which the remarkable sympathy which subsists between the body and the mind is so clearly seen as in dyspepsia. The consequence of this sympathy is, that the patient looks at every thing in the darkest and blackest light; magnifies trifles into affairs of moment; is tormented with a constant, cavilling, wretched sensitiveness. It is necessary, then, not only that the body should be exercised, and its muscles actively used; not only that the stomach should be as little distressed by work as possible; not only that change of air, frequent change of air, should be enjoyed; but it is necessary, moreover, that the mind should be taken away from its cares and troubles, from the customary sources of vexation; and be amused with variety, without knowing how: an amusement that is well furnished by the fresh scenes, the fresh faces, and the various and numberless interesting matters for observation, that a tract of country before unknown to him must ever present, even to the commonest observer.

Travelling, and especially pedestrian travelling, presents, among its many other points of excellence, this, in a remarkable degree. It acts directly on the mind as well as on the body. I am satisfied that if the measure were tried in cases of hypochondriacism, and even in many a case of incipient insanity, numbers would be restored to their reason, their families, and their friends. The effect of such travelling can

hardly be sufficiently estimated. It would enable many an invalid, at a cheap and easy rate, to show "a clean bill of health;" and there are few who would consider the prescription to be otherwise than palatable.

CHAPTER V.

On the Hygienic effects of Clothing.—Functions of the Skin.—Extent and Character of the Cutaneous Secretions.—Effects of the Cutaneous and Pulmonary Exhalations.—Sympathetic Dependence between the Skin, Mucous Membranes, &c.—Materials of Clothing.—Good and Bad Conductors of Heat.—Relative amount of Protection to the System afforded by the Wear of Articles made of Flax, Cotton, Silk, and Wool.—Electrical Phenomena of the Animal Economy.—Use of Silk, Flannel, Leather, Cotton, &c., worn next to the Surface of the Body.—Value of Flannel worn as an Undergarment, in different Climates and Circumstances.—Dr. James Johnson, on the Hygienic Effects of the Costumes of the Oriental Nations.—Importance of Adequate Clothing to the Feet.—Comments on some dangerous Customs in regard to Dress.—Strictures on the Use and Abuse of Stays.—Effect of the Bed and Bed-Clothes on Health and Disease.—Radiation of Heat.—Colour of Clothes, and its Effect.—A Suggestion for the Sick Room.

THE great extent of the surface of the body, and the large amount of the secretion that is constantly proceeding from it, either in the unperceived form of a vapour, or in the form of a fluid, renders the regular and adequate discharge of the functions of the skin not only important to health, but necessary even to the continuance of life.

In men of average size, the extent of the surface of the body is computed to be no less than 2500 square inches; and M. Seguin found, that, on an average, 18 grains of fluid were discharged in the minute, by

the skin and the lungs,—of which, the skin was computed to exhale 11, and the lungs 7 grains. The minimum exhalation from both the cutaneous and pulmonary tissues, amounted in these experiments to 11 grains per minute; the maximum exhalation, when the system was in a state of rest, was found to be 32 grains per minute. According to these data, the maximum of matter lost or expended in these ways in the course of 24 hours, amounts to 5 pounds, and the minimum to 1 pound, 11 ounces, and 4 drachms; or, taking the average of 11 grains in the minute, the whole quantity amounts to 29 ounces of fluid. To arrive at some of these results, M. Seguin had himself securely fastened up in a bag, made of a thin and impervious material, with an aperture in it, the edges of which were fastened to his lips with a mixture of turpentine and pitch; by which contrivance, the whole of the pulmonary exhalation was permitted to escape, while the whole of the cutaneous secretion was retained in the bag. By causing himself to be weighed carefully, in an accurate balance, before the experiment, and again before leaving the bag, and again after he had got out of the bag, deducting the loss sustained before leaving the bag from the total loss, he was enabled to estimate the amount expended during the time, both in the pulmonary and in the cutaneous exhalations.

There is a comparatively small amount of solid constituents lost to the system in these exhalations; not supposed to exceed 7 or 8 scruples in the 24 hours;

the large remainder being mere water, together with carbonic acid, and perhaps some nitrogen.

Under some circumstances, there is sufficient reason to believe that a much larger amount of exhalation may take place from the lungs and the skin, than even the experiments of M. Seguin would have led us to infer. Dr. Southwood Smith relates some observations that were made upon labourers at the Phoenix Gas Works, who were employed twice a day in drawing and charging the retorts, and in making up the fires, which usually occupies about an hour; the labour is performed in the open air, but involves the exposure to a considerable degree of heat. On a foggy and calm day at the end of November, when the temperature of the external air was 39° , and the men continued at their work for an hour and a quarter, the greatest loss observed was 2 pounds, 15 ounces; and the average loss of eight men was 2 pounds, 1 ounce. On a bright clear day, in the middle of the same month, when the temperature of the air was 60° , without much wind, the greatest loss was 4 pounds, 3 ounces; and the average loss was 3 pounds, 6 ounces. And on a very bright day in June, when the temperature of the air was again 60° , without much wind, the greatest loss (occurring in a man who had worked in a very hot place) was 5 pounds, 2 ounces; and the average during the hour that was lost by the men severally, was 2 pounds, 8 ounces.

In truth, the age of the individual, the sex, the

dryness or moisture of the air, the temperature of the air, the degree of the exertion that is being made, the condition of the system, as to health or ailment, as to weakness or strength, will, each and all, considerably modify the amount of the exhalations from the body, as well as modify their character. There is little doubt, that, under circumstances of extreme exertion, as well as under those of many forms of bodily indisposition, a considerable amount of animal matter, as well as saline matter, is carried out of the body in this way. The principal ingredient of the salts of the exhalations is chloride of sodium; they have usually a slight acid reaction, due probably to a mixture of acetic, lactic, and butyric acids, in variable but very minute proportions, according to the health and strength of the system; there are generally likewise traces of ammonia, and of an animal extractive matter.

Of the extent of the secretions from the skin, no more need be said. The importance of its functions in this respect, is no less great. Of so great moment are they, that whatever unduly checks these secretions,—as cold, by suddenly or rapidly carrying off its heat, and impeding the circulation of the blood through the vessels which are ramified over it,—is almost certain to be followed by more or less indications of morbid action. The amount of the cutaneous exhalations is increased by a light and dry atmosphere; and is lessened by a damp, vapoury, dense, and calm atmosphere. During and immediately after the meals, the exhalation is said to be at its minimum;

and it is considered to attain its maximum during the actual period of digestion, and especially when the chyle has reached the circulation, and is becoming converted into blood,—and, likewise, it is probable, that the secretion goes on more rapidly during sleep, than when the body is not undergoing positive exertion when awake. The exhalation from the skin is evidently to some degree antagonised by that from the pulmonary tissue, and still more so by the secretion from the kidneys. An excessive secretion of urine is always attended with a lessening of the amount of cutaneous exhalation; and, conversely, the renal functions are less energetic when the skin exhales freely. If the relative and equipoised action of the several excretories of the system is suddenly or greatly disturbed, there is always a risk that the diminished secretion of one tissue or organ, may not be atoned for in due degree by the increased secretion from one or other of the other excreting structures, and that diminished waste, and unexpended effete matters, may lead to functional derangement, and eventual disorder of the economy of the body. Besides this necessary consequence of the cutaneous exhalations serving in so far an excreting effect, and being a source of waste and expenditure to the system, these exhalations unquestionably serve the further purpose of diminishing the temperature of the body, and in so far aid in equalising the animal heat, under the differing circumstances of weather, season, and climate.

But this is not all. There is besides these purposes

and effects, a sympathetic dependence between the several organs and functions of the body, that has to be recognised and allowed for : a sympathy obviously communicated through the medium of the nerves which supply them with their properties and their powers. This sympathy subsists perhaps in an especial degree, between the skin and the mucous membrane. This is well illustrated by the chilled condition of the surface of the body, amounting at times to that called "goose skin," which the digestion of a heavy dinner so frequently occasions,—or which may be induced by the digestive process, whatever the quantity or the nature of the food that has been taken, when the system has been much weakened, whether from disease or over-fatigue. The converse of this is illustrated by the common occurrence of indigestion, when the surface of the body is chilled by exposure to a cold and wet atmosphere. The first of these cases might be partly explained, by the fact that so much more blood would have to be directed to the stomach, to enable it to digest so large a mass of food, or a meal that, however small, might prove to be disproportioned to the enfeebled condition of the system ; but the other case involves an exclusive appeal to sympathetic action for its explanation. As further illustrations of this curious and important connection between different and remote organs and textures, it may be mentioned that when, either from excessive heat or excessive cold, the powers of the skin are depressed, those of the stomach are usually depressed too. Few men

are happy enough to retain their appetites in a hot summer's day, or in the cold and damp day of winter. On the other hand, if the cold or the heat is not sufficient in its degree, to overcome the powers of the system, but only serves to rouse it into an effort to resist such influence, the effect is to increase the energies of the skin; and the energies of the stomach are found to be, in an equal ratio, excited and increased.

The inference from such facts is obvious, that, to preserve the due balance of the circulation,—a balance which cannot be disturbed without some degree of consequent congestion, and without risk of setting up inflammation in some of the organs; to encourage the cutaneous exhalation,—a secretion which cannot be materially lessened in its degree without involving a corresponding degree of fulness of the blood-vessels, a fulness which is almost always fraught with danger; and to prevent the sympathetic disorders of other organs, which are so apt to follow a disturbance of the functions of the skin; it is necessary that the surface of the body should be protected by such an amount of clothing, as shall be uniformly proportioned to the climate and the season.

Substances part with their heat in two ways: the one by contact, the other by radiation. I have at present only to do with articles of clothing. So far as these are concerned, both modes must be briefly considered.

Some substances neither readily receive, nor readily part with heat; others receive it quickly, and part

with it quickly. The former are called bad, the latter good conductors of heat ; the former are warm to the touch, the latter are cold ; the bad conductors afford the best protection against the cold, the good conductors afford the least protection against it ; the bad conductors confine most completely the animal heat, the good conductors allow it the most readily to pass through them. The following, beginning with the best conductors, may be considered to be the order in which they ought to be classed :—

- | | | | |
|----------|------------|----------|----------|
| 1. Flax. | 2. Cotton. | 3. Silk. | 4. Wool. |
|----------|------------|----------|----------|

Flax is a much better conductor than cotton ; cotton is a somewhat better, but not much better, conductor than silk ; silk is a much better conductor of heat than wool. It may prove to be at once more succinct and more useful, to name the raw materials of the several articles of clothing in this way, than to attempt an enumeration of the several fabrics individually. It is sufficiently easy to estimate the comparative warmth and protection to be expected from any article of clothing, by knowing the material or materials of which it is manufactured. Thus, all woollens, as cloths, worsteds, stuffs, merinoes, &c., are warmer articles of wear, than silks, spun silks, &c.; and these, than calicocs, common prints, &c.; and these, than linens, muslins, cambrics, &c.

It is necessary to add to these four principal raw materials of manufacture, some few other articles, which are more or less directly used to protect the surface of the body from the cold. Thus, feathers

are bad conductors; and, à fortiori, down is pre-eminently a bad conductor. The quilt lined with Eider down, is, from its extreme lightness and remarkably non-conducting property, a priceless comfort to the easily chilled surface of the invalid. Hair, when woven into a cloth, is *rather* a good conductor; but in the state of fur, is a very bad conductor. Wood, and more especially cork, is a very bad conductor. Leather and dressed skins are bad conductors, and might probably be classed as little less so than wool.

The position that articles made of silk should occupy in such a comparative estimate of the degree of protection afforded to the surface of the body, would be necessarily affected a good deal by the degree of thickness or thinness of the manufactured fabric. The greater costliness of the raw material, makes this a consideration of more importance in the case of this, than in that of the other fabrics. Silk has, moreover, another physical characteristic, which adapts it pre-eminently to be an important article of clothing. It is singularly notable as a non-conductor of electricity.

However little or unsatisfactory our knowledge of the operations of this remarkable agent in the animal economy, there is no doubt that electricity fulfils important and necessary purposes in the living system, and that a certain amount of positive or negative electricity is being constantly given off from the surface of the body, in greater or less degree, according to sex, temperament, weather, the nature of the clothing, &c. It has been said, that the skin

and most of the internal membranes are in opposite electrical conditions; and, according to a theory of Dr. Wollaston, the existence of free acid in the urine and gastric juice, marks the prevalence of positive electricity in the kidneys and the stomach; whereas the existence of free alkali in the bile and the saliva, indicates an excess of negative electricity in the liver and the salivary glands. Whether this view be tenable or not, it seems that the living body is never in a state of perfect electrical equilibrium, with the substances or bodies around it, unless it be maintained by free contact with them; and it is stated, in illustration of this, that if two persons, both insulated, join hands, sufficient electricity is developed to influence the electrometer. "Some electrical disturbance is manifested by almost every individual, if it be carefully sought for. In men, it is most frequently positive; and irritable men, of sanguine temperament, have more free electricity, than those of phlegmatic character; whilst the electricity of women is more frequently negative than that of men. Some individuals exhibit these phenomena much more frequently and powerfully than others. There are persons, for instance, who scarcely ever pull off articles of dress which have been worn next the skin, without sparks and a crackling noise being produced, especially in dry weather; this may, however, be partly due to the friction of these materials on the surface and with each other, as it has been proved to be greatly influenced by their nature. The most remarkable ease of the generation of electricity in

the human subject at present on record, is one that has been met with in America. (American Journal of Medical Science, January, 1838). The subject of it, a lady, was for many months in an electric state so different from that of the surrounding bodies, that, whenever she was but slightly insulated by a carpet or other feebly conducting medium, sparks passed between her person and any object which she approached. From the pain which accompanied the passage of the sparks, her condition was a source of much discomfort to her; when most favourably circumstanced, four sparks per minute would pass from her finger to the brass ball of the stove, at the distance of $1\frac{1}{2}$ inch. The circumstances which appeared most favourable to the generation of electricity, were an atmosphere of about 80° , tranquillity of mind, and social enjoyment; while a low temperature and depressing emotions diminished it in a corresponding degree. The phenomenon was first noticed during the occurrence of an Aurora Borealis; and though its first appearance was sudden, its departure was gradual. Various experiments were made with the view of ascertaining if the electricity was generated by the friction of the articles of dress; but no change in these seemed to modify its intensity.* It was no doubt generated, or the electrical equilibrium was disturbed in an undue and very extraordinary degree, by the condition of the nervous system, probably influenced by some

* Principles of General and Comparative Physiology. By William B. Carpenter, M.D., &c.

deranged condition of certain of the organic functions. It seems to have been proved, that electrical manifestations are the invariable consequence of the action of the nerves in producing muscular action ; and it is probable, that this powerful agency of electricity exercises an important influence on the digestive processes, and perhaps especially in facilitating the decomposition of the food, and so far preparing it to enter into new combinations for the nutrition of the body. But, however this may be ; and however large, or little important, the influence of electricity may be, in carrying on the vital and organic processes of the system ; there is no doubt that a certain amount of electrical matter is constantly being given off from the surface of the living body,—that the amount of this varies according to the dryness or dampness, the coldness or warmth, of the atmosphere,—and that the degree to which it is permitted to escape, may be influenced by the nature of the clothes, and particularly according to the nature of the fabric which is worn next the skin,—and that the escape of this electricity is so far attended with diminished power and energy of the general economy, and in the same degree to which such escape may be prevented, is the system maintained in a state of more vigorous vitality. The depressing influence of wet and cold weather, may be largely referred to the effect of such an atmosphere in carrying off rapidly the free electricity of the system ; and the colder and more damp the climate man lives in, the more important is it that he surround the

body with such articles of clothing, as will check, as far as may be, the escape of this extraordinary agent; and the greater the habitual depression and debility of the economy, the less the degree of its vital energy, the more important does this consideration become.

Silk, as a remarkable non-conductor of electricity, deserves to be made use of more generally than it is in this country, as an article of under-clothing. For this purpose, it should be woven entirely of what is called *bright* or *wrought* silk, in contradistinction to what is called *spun*, or *spurious* silk; and the under-garment is to be manufactured in a similar way, and of a similar material, to stockings,—but woven with much thicker thread, into a very thick and heavy fabric. Where the expense of this provision cannot be conveniently incurred, an under-garment of flannel, or of a correspondingly thick and close woollen web, should be always preferred.

In a climate like ours, which is so variable, and usually so cold, the article of dress that is worn next the skin ought always to be a bad conductor of heat, at all events. In general, flannel, of an adjusted degree of thickness and fineness, answers this intention sufficiently well, without proving to be too heating, or irritating, or relaxing. In summer time, if the flannel which proved to be well borne in the colder seasons of the year, should be so far irritating and heating as to relax or fever the system, this may be remedied by substituting for it a thinner and finer quality of flannel; or, in extreme cases of this kind, an under-garment of calico, of a proper degree of

thickness, may be substituted for the flannel at that season of the year.

Many prefer wearing leather as the under-garment, because it does not irritate the skin so much as flannel. Leather is chiefly objectionable, from its not affording, however well dressed, so ready a passage to the insensible perspiration, as flannel or calico. I think that thin and very fine flannel may generally be well borne, and must be always greatly preferable; or that this, lined with calico, or even calico alone, is generally much better than the use of leather for this purpose. Linen ought not to be worn next to the skin, unless by the very robust.

But, strongly as the importance of having a bad conductor of heat next to the skin should be impressed on the mind, there is a point connected with it, which is almost as important. This inner garment, especially if made of flannel, ought not to be worn at night. It ought invariably to be taken off at night, and as invariably to be resumed in the morning. In bed it is unnecessary; it is worse than unnecessary, for it does harm: it then unduly stimulates the skin, and produces a preternatural waste of the secretions, and corresponding debility of system,—a corresponding liability to suffer from the depressing influence of cold,—a corresponding incapability of resisting its influence. But, further, removing this garment during the night, relieves it from the scurf, some degree of dampness, and other impurities, which it must acquire during a day's wear, and so renders it fresh, and more agreeable to the sensations of the

wearer. Not wearing it at night, renders it more effectual in protecting the surface from the cold by day,—on the principle, that a great coat is not of the same service to the wearer when out of doors, if he is in the habit of wearing it in the house.

It would be easy to adduce strong evidence in behalf of the value and importance of wearing flannel next the skin. “Sir John Pringle,” says Dr. Hodgkin,* “who accompanied our army into the North at the time of the rebellion, relates that the health of the soldiers was greatly promoted by their wearing flannel waistcoats, with which they had been supplied on their march by some of the Society of Friends;” and Sir George Ballingal, in his Lectures on Military Surgery, adduces the testimony of Sir James Macgrigor to the statement, that, in the Peninsula, the best clothed regiments were generally the most healthy; adding, that, when in India, he witnessed a remarkable proof of the usefulness of flannel, in checking the progress of a most aggravated form of dysentery, in the second battalion of the Royals. Captain Murray told Dr. Combe,† that “he was so strongly impressed from former experience with a sense of the efficacy of the protection afforded by the constant use of flannel next the skin, that when, on his arrival in England, in December, 1823, after two years’ service amid the icebergs on the coast of Labrador, the ship was ordered to sail immediately for the West Indies, he ordered the purser to

* Lectures on the means of Promoting and Preserving Health.
By T. Hodgkin, M.D.

† Opus Citatum.

draw two extra flannel shirts and pairs of drawers for each man, and instituted a regular daily inspection to see that they were worn. These precautions were followed by the happiest results. He proceeded to his station with a crew of 150 men; visited almost every island in the West Indies, and many of the ports in the Gulph of Mexico; and, notwithstanding the sudden transition from extreme climates, returned to England without the loss of a single man, or having any sick on board on his arrival. It would be going too far to ascribe this excellent state of health solely to the use of flannel; but there can be little doubt that the latter was an important element in Captain Murray's success."

There can be no doubt that flannel is by much the best article for being worn next the skin, when the body has to be exposed to such a temperature, or to such a severe degree of exercise, as increases the perspiration in a material degree. It retains a warm and dry atmosphere next to the body, while, from its porous and fibrous character, it carries off the moisture to the external surface of the flannel. This is well seen when horses are stabled in a state of heat and perspiration, after a journey; and covered with the usual clothing. Very soon, it will be found that the outside of the woollen clothing is quite wet, and often studded with drops of moisture, whereas the skin of the horse and the inside of the clothing are perfectly dry. The common practice among the workmen in potteries, foundries, collieries, &c., of wearing thick

flannel shirts, tends much to preserve their health, under the circumstance of the profuse perspiration caused by the excessive labour they are called upon to undergo, or the extreme heat of their places of work, alternated as this must be with the much colder atmosphere out of doors, amounting it may be to a difference of temperature of no less than 60 or 70 degrees. Dr. Kilgour says,* “that the use of flannel was found to be beneficial in the prevention of cholera, by maintaining the equilibrium of the temperature and functions of the skin,” and thereby preventing that derangement of the bowels which is so general a sequence of cold applied to the surface; and Major Denham (*vide* Denham and Clapperton’s Travels) says,—“On the 23rd of April, the heat was insufferable; for several hours in the middle of the day, the thermometer was as high as 113°. Covering myself up with all the blankets I could find, afforded me the greatest relief,—these defended me from the power of the sun, as well as from the flies:” evidently on the same principle that the ice in our ice-houses is surrounded with old carpets, or blankets, or other woollen or badly conducting materials! For the following valuable observations on this very important hygienic question, we are indebted to the late Dr. James Johnson’s excellent and standard work, on “The Influence of Tropical Climates.” “We observe both Hindoo

* Lectures on Therapeutics and Hygiene. By Alexander Kilgour, M.D., &c.

and Mahomedan guarding most cautiously against solar heat, as well as cold. The *turban* and *cummerbund* meet our eyes at every step :—the former, to defend the head from the direct rays of the sun ; the latter, apparently for the purpose of preserving the important viscera of the abdomen from the deleterious impressions of cold. The cummerbund is certainly a most valuable part of their dress ; and one that is highly deserving of imitation. Such are the *essential* articles of native dress ; the light, flowing robes of cotton, silk, calico, &c., varying according to the taste or circumstances of the wearer, and being more for ornament than use. A very good substitute for the *turban* is a large cotton handkerchief, folded up in the hat ; and where we are exposed to the direct influence of solar heat, it may, with much advantage, be kept moistened with water. In situations where atmospherical vicissitudes are sudden, a fine shawl round the waist forms an excellent *cummerbund*, and should never be neglected, especially by those who have been some time in the country, or whose bowels are in any degree tender. When we enter the tropics, we must bid adieu to the luxury of linen—if what is both uncomfortable and unsafe in those climates, can be called a luxury. There are many substantial reasons for doing so. Cotton, from its slowness as a conductor of heat, is admirably adapted for the tropics. It must be recollected, that the temperature of the atmosphere, *sub dio*, in the hot season, exceeds that of the blood by many degrees ; and, even in the shade, it too often equals, or rises

above, the heat of the body's *surface*, which is always, during health, some degrees below 97° . Here, then, we have a covering which is *cooler* than linen ; inasmuch as it conducts more slowly the *excess* of external heat *to* our bodies. But this is not the only advantage, though a great one. When a *vicissitude* takes place, and the atmospherical temperature sinks suddenly far below that of the body, the cotton, still faithful to its trust, abstracts more slowly the heat *from* our bodies, and thus preserves a more steady equilibrium there. To all these must be added the facility with which it absorbs the perspiration ; while linen would feel quite wet, and, during the exposure to a breeze under such circumstances, would often occasion a shiver, and be followed by dangerous consequences. That woollen and cotton should be *warmer* than linen in low temperatures, will be readily granted ; but that they should be *cooler* in high temperatures, will probably be much doubted. If the following easy experiment be tried, the result will decide the point in question. Let two beds be placed in the same room at Madras, we will say, when the thermometer stands at 90° ; and let one be covered with a pair of blankets, the other with a pair of linen sheets, during the day. On removing both coverings in the evening, the bed on which were placed the blankets will be found *cool* and pleasant ; the other uneomfortably warm. The reason is obvious. The linen readily transmitted the heat of the atmosphere to all parts of the subjacent bed ; the woollen, on the contrary, as a non-conductor, prevented the

bed from acquiring the atmospherical range of temperature, simply by obstructing the transmission of heat from without. This experiment not only proves the position, but furnishes us with a grateful and salutary luxury, free of trouble or expense. The musical ladies of India are not unacquainted with this secret, since they take care to keep their pianos well covered with *blankets* in the *hot season*, to defend them from the heat, and prevent their warping. From this view of the subject, *flannel* might be supposed superior to *cotton*; and, indeed, at certain seasons, in particular places—for instance, Ceylon, Bombay, and Canton, where the mercury often takes a wider range, in a very short space of time, the *former* is a safer covering than the latter, and is adopted by many experienced and seasoned Europeans. But, in general, flannel is inconvenient, for three reasons. First, it is too heavy; an insuperable objection. Secondly, when the temperature of the atmosphere ranges pretty steadily a little below that of the skin, the flannel is much too slow a conductor of heat *from* the body. Thirdly, the spiculæ of flannel prove too irritating, and *increase* the action of the perspiratory vessels on the surface, when our great object is to *moderate* that process. From the second and third objections, indeed, even cotton or calico is not quite free, unless of a fine fabric, when its good qualities far counterbalance any inconvenience in the above respects. In some of the upper provinces of Bengal, where the summer is intensely hot, and the winter sharp, the dress of

the native shepherds, who are exposed to all weather, consists in a blanket, gathered in at one end, which goes over the head, the rest hanging down on all sides like a cloak. This answers the triple purpose of a *chattah* in the summer, to *keep out* the heat—of a tent in the rainy season to throw off the wet—and of a coat in the winter, to defend the body from the piercing cold. Hence our ridicule of the Portuguese and Spaniards, in various parts of the world, for wearing their long black cloaks in summer, ‘*to keep them cool,*’ is founded on prejudice rather than considerate observation.” The plaid worn by the shepherds and peasantry of Scotland, one of the best and most useful of all outer-garments, is a curious illustration of the same sort of garment being made use of in these latitudes, as that adopted by the shepherds of Bengal.

There is, in all cases, some risk, that the non-conducting character, and the amount, of the clothing that is worn, may be too great for the mere purposes of protection to the surface of the body, and the maintenance of the temperature and functions of the skin. This objection is strongly applicable to the use of fur worn next to the skin; and may be applied to the local or general use of so much of a thick fleecy hosiery, as would keep the surface of the skin covered by it in a constantly damp and relaxed condition.

But, of all parts of the body, there is not one, the clothing of which ought to be so carefully attended to, as the feet. The most dependent part of the

system, this is the part in which the circulation of the blood may be the most readily checked; the part most exposed to cold and wet, or to direct contact with good conducting surfaces, it is the part of the system where such a check is most likely to take place. Coldness of the feet is a very common attendant on a disordered state of the stomach; and yet disordered stomach is not more apt to produce coldness of the feet, than coldness of the feet is apt to produce disorder of the stomach; and this remark does not apply only to cases of indigestion, but to many other disorders to which man is liable. Yet do we see the feet of the young and the delicate, clad in thin-soled shoes, and as thin stockings, no matter whether it is summer or winter time; no matter whether the weather is dry or damp, or whether the temperature of the atmosphere is warm or cold. But this is not the whole of the evil. These same feet are frequently, at different times of the same day, differently covered as to the stoutness of the shoes and their soles, and very often likewise as to the thickness of the stockings. I have often found, on investigating into the origin of cases of disease, that it has been a common practice to go out of doors in the forenoon, the feet being protected with lamb's-wool stockings, and warm and thickly-soled boots; and to sit in the afternoon at home, only having the feet covered with silk stockings and thin satin shoes. I have so often found this to be the case, that it would hardly surprise me were the practice found to be almost universal among the females of the middle

and upper ranks of society. To this common, and sufficiently inconsiderate practice, I have traced many cases of incurable disease. To this alone may be ascribed many a case of functional disturbance; this lays the foundation for many of those derangements, by which the first inroad is made into the constitution, the first step taken in undermining the health, the first of that succession of changes brought about, by which the young, and the lovely, and the healthy, are converted into the wasted victims of consumption, or become martyrs to other maladies as fatal, although less common. I am sufficient of a Goth to wish to see thin-soled shoes altogether disused as articles of dress; and I would have them replaced by shoes having a moderate thickness of sole,—with a thin layer of cork or felt placed within the shoe, over the sole, or next to the foot. Cork is a very bad conductor of heat, and is therefore to be preferred; if it is not to be had, or is not liked, felt may be substituted for it. The extreme lightness of the cork,—the remarkable thinness to which it may be cut, its usefulness as a non-conductor not being essentially impaired thereby,—and the inappreciable effect it has on the appearance of the shoe; all seem to recommend its use for this purpose, in the strongest manner. I think that neither boots nor shoes should be used without this admirable provision against cold feet. There is sufficient objection to all shoes made of waterproof or impervious materials: they are apt to prove much too heating and relaxing; interfering with the due escape of the cutaneous exhalations. Thin shoes

ought only to be used for the purpose of dancing ; and then they ought only to be worn while dancing. The invalid or dyspeptic ought assuredly never to wear thin shoes at other times. As to the common practice of changing thin shoes for warm boots, and vice versâ, it is a practice that is replete with danger, and therefore rash and almost culpable.

I will venture to touch, as briefly as may be, on the extreme imprudence,—not to give what may be the mere effect of thoughtlessness, a worse name,—of having the morning, the walking, and the evening dress made of such very different materials, and in so very different a degree protective against the cold. How perfectly unreasonable it is to cover the neck and shoulders and arms at one period of day, and to leave them uncovered at another ; to wear a warm thick dress at breakfast, made to cover duly the neck and arms, and a cold thin dress at dinner, leaving so much of the person entirely uncovered,—and in this imperfect attire, to expose the person to the cold air of passages, halls, stair-cases, or perhaps to the totally unmodified and unwarmed air of the evening or the night ! It need not be said, how common this is, nor what a direct contravention it is of the organic laws. It should not be lost sight of, moreover, that such acts of imprudence may possibly, while the health continues in high and unimpaired vigour, be followed by no bad consequences ; yet that the slightest cause of disturbance or exhaustion, such as sitting up one single night to a later hour than usual, or a slight attack of indiges-

tion, or over-fatigue, or contracting cold feet, or any other equally probable circumstance, may destroy the happy equilibrium, and enable the cold to check the circulation of the blood in the skin, and thus to throw the blood upon some vital organ, giving rise to immediate disorder, and perhaps to ultimate and not remote disease:—a man may get drunk every night, and, in a state of intoxication, mount his horse, and ride a distance of some miles to his home, and he may do this for months without any accident; but these escapes do not lessen the amount of the risk which he runs; he is still liable to suffer, and perhaps to be killed, by the stumbling or shying of his horse, or by any other equally probable accident. The application is evident enough.

There is another custom, or habit, or usage, in the dress of my fair countrywomen, which must be noticed. It is that of covering the head with a cap in the morning, and leaving it uncovered in the afternoon or evening. It is an indefensible custom, and by no means free from risk.

It has often been urged, that so careful a protection of the surface of the body from the influence of cold, has a tendency to relax and enfeeble the system, to predispose it to suffer from accidental exposure to cold or wet, or to the other common causes of derangement or disease. There is no doubt that the system may be enfeebled, and disease indirectly induced, by too much clothing, and too little exposure to atmospheric influence; but, on the other hand, although some lives might be spared to survive a system of

exposure to the atmospherical changes in these high latitudes, the larger proportion of the lives would be sacrificed; and more particularly during infancy, and indeed, more or less, throughout the immature stages of life. The large mortality among the children of the poor, is to be referred to an undue exposure of their feebly acting and sensitive surfaces to the influence of the cold, as well as the other ways in which the laws and wants of the organisation are interfered with or unattended to. It by no means follows, moreover, from what has been said, that people's systems are to be overheated, or their surfaces relaxed, or their systems enfeebled, by an excessive amount of clothing,—an amount disproportioned to the requirements of health and strength. The single instance in which people appear to be apt to clothe themselves in an undue degree in this country, is the surrounding the neck with thick kerchiefs or shawls in cold weather. Unless when much, or unusually, exposed to the influence of cold, the risk of local relaxation from this practice, and of an unadvisable degree of chill when such extra clothing is removed, deserve consideration; and may lead to greater evils than such extra clothing is calculated to obviate. The same remark applies to the use of various warm articles of dress, made of fur, &c., worn round the neck and shoulders. They are usually much too heating, and consequently relaxing; and are only justifiable under circumstances of extreme and long continued exposure to cold, or in the instances of very delicate and

susceptible systems : much after-care being necessary in either case.

But the custom, of all other customs the one that is the most directly opposed to the dictates of nature,—that is at once the most unreasonable and the most dangerous,—is that of tight-lacing; I had almost said, that of wearing stays. Habit leads men to the most unnatural conclusions. Fashion and custom are the parents of absurdity. Much as we may laugh at the effects which these produce on other nations,—much as we may ridicule the compressed, crippled, and useless feet of the Chinese females,—they do not interfere directly with any important or indispensable vital organ by the practice. Much as we may view, with an amused feeling of superiority, the blackened teeth, the skin painted with many colours and grotesque devices, and the be-ringed nose and lips of the savage, yet these are only what they purport to be; they are in their eyes ornamental; they do not interfere with the exercise of a single function; they do not even tend to disorder the health, injure the constitution, and curtail the, at best, short span of human life. I believe it to be far different with the European custom of wearing stays.

The natural respiration, when not interfered with by any such means, is chiefly accomplished by means of the diaphragm; the rise and fall of the abdomen is the effect produced by the respiratory process; and, unless during or immediately after active exertion, the chest is very little raised during respiration, or the ribs expanded by it. It will be found that females,

encircled with the ordinary encasement of stiff and little-yielding stays, are obliged to respire almost exclusively by the expansion of the chest, and the raising of the ribs. The effect of this great interference with the mode of performing so constant and important a function, may well be to diminish the probability of its due discharge, and to risk the supervention of corresponding functional, and eventual organic disturbance, in the heart or the lungs,—and it may still more obviously and usually interfere with the due action of the stomach, the liver, and the bowels, by removing from them the agency of so much and such constant muscular movements, as the respiration by means of the abdominal muscles necessarily involves. In many instances, in addition to this very sufficient cause of functional disturbance, the busk, or central bone, or steel, of the stays, presses on the stomach; and I have occasionally met with cases of gastric derangement that were evidently referable to this cause alone. The most important of the bad consequences of the use or abuse of stays to the well-being of the physique, remains to be mentioned. The muscles of the spinal column being compressed by the stays, and their mobility being diminished by them, and their use and exercise being so far lessened or prevented, and the support of the back being no longer dependent exclusively on the exercise of these muscles, the consequence is, that they become smaller, more flaccid, and weaker; and any cause of further debility that may affect them, is attended with the risk of consequent deformity,—of spinal

irritation in the first instance, and spinal curvature in the end.

These, however, may be said to be effects that are more or less risked in all cases, by what may be considered to be the *use* of stays. Their *abuse*,—an abuse which female vanity, or maternal pride, is ever producing,—is followed by consequences that are still more immediately serious. The ribs, which form such elastic and yielding, yet such firm and protective walls to the thorax,—connected behind to the spine, and before to their cartilages,—the cartilages affording the means of attachment to the sternum, and increasing the elastic expansibility of the chest,—may be affected to almost any degree by outward pressure; the elasticity with which the walls of the chest have been endowed for wisest purposes,—to afford the fullest protection against injury from without to the heart and the lungs, while the risk of any undue pressure, or undue resistance to the full exercise of their functions, was intended to be, as far as possible, obviated by these means; these very qualities are, by tight-lacing, converted into pregnant sources of evil. The ribs and their cartilages yield to the pressure, the outward form of the chest becomes completely altered; the deep and full and ample natural volume of the chest becomes permanently cramped and contracted, notwithstanding a marked effort that is made by the system to atone for the diminished space below, by causing the upper parts of the chest to become unduly expanded; and the respiration and the

heart's action are so far interfered with, and phthisis or disease of the heart is the probable and the frequent result.

I am quite aware that all which could be written on this subject, might not be effectual in causing the use of stays to be discontinued: indeed habit may be said to have rendered them almost a necessary part of female dress. But, as a sort of "forlorn hope," I beg leave to offer the following suggestions:—Stays should not be worn, under any pretence or any circumstances whatever, until as late an age as possible; and certainly not before twelve or thirteen years old. The older the individual, the less soft and the firmer are both the ribs and their cartilages, and the less liable to be bent in a material degree by a moderate amount of pressure. Stays should, moreover, always be worn with as few, and as thin, and as yielding bones as possible, and with as elastic and yielding a busk as may be; and the stays should be always loosely laced. The larger evils which result from the use of stays will be avoided, if these suggestions are attended to; and the feelings or prejudices of society be sufficiently studied: women will not be seen without stays. Stays are in fact useless: the spinal column wants no artificial or external support. The way to make it want support, is to support it; and in this way to weaken the muscles. The only possible end which the use of stays can serve, is to confine and give rigidity to the figure: an effect which might be sufficiently produced, without ungraceful stiffness, by a stout linen or cotton

under-garment, made to fit accurately to the body. By this, the figure might be sufficiently confined, and any justifiable pressure afforded; while the pressure would be equable, and would be at no point unyielding; while the muscles of the back would not be weakened by the provision of a useless support to the spine; while the natural abdominal respiration would not be interfered with; while the stomach would not be unduly pressed upon; while the ribs would not be deformed, nor the cavity of the chest be contracted.

I have made an appeal to reason and common sense; but habit and fashion are too firmly seated on their tyrant thrones, to give me ground for much hope that the appeal will be successful. Even if the understandings have been convinced, the trite old satire of the Latin poet may still be applicable:—

I see the right, and I approve it too ;

Condemn the wrong, and yet the wrong pursue.

OVID.—*Tate's Translation.*

It has been said in a former part of this chapter, that, when in bed, the skin usually throws off much more of its secretions than it does at other times: and this is the case, other things being equal, in direct proportion to the quantity of the bed-clothes, and the degree to which the bed-clothes and the bed are bad conductors of heat. It is not too much to say, that many lives have been sacrificed to an inattention to, or an ignorance of, the great principle that, in this way, the bed and the bed-clothes exhaust materially the powers of the system. Everybody

knows how essential are rest and quietude, and a total avoidance of all excitement, whether mental or bodily, to many cases of disordered health. The consequence is, that many are ordered, under such circumstances, to lie in bed altogether. By and by, treatment and time remove the active or inflammatory character of the ailment, and a considerable degree of languor and exhaustion is experienced, or a high amount of irritability; and these conditions are followed by much prostration of the vital energies. I have reason to know that a patient may sink from these causes, and these causes only; and it is much more frequently the case that the continuance of this greatly enfeebled condition of the system, a condition so notoriously and remarkably predisposing to the occurrence of organic disease, leads to the lapsing of the constitution into such a permanently incurable condition. It is a matter of constant observation, how very slowly patients progress in their convalescence, until they have left their beds, and have managed to recline, for a longer or a shorter time every day, on the sofa. It repeatedly occurs, that the nights and days are alike sleepless, the bowels obstinately constipated, all the secretions (unless those of the skin) scanty, and the feelings depressed, until the patient is got out of bed for an hour or two every day, and the vessels of the skin, and the system generally, are relieved from the exhausting effect of the bed and the bed-clothes.

While it is needful for every one to keep his surface warm in bed, yet this may be carried too far; or the

necessity for more than a certain amount of such means may be materially diminished. A free and sufficient use of exercise, and particularly walking exercise ; a regular exposure to the open air ; a daily change of air, as far as may be practicable,—walking as far away from home as strength, and time, and weather allow, instead of confining the exercise to a circle near the house ; and a regulated diet ; are the great means, next to sufficiently frequent ablutions, of keeping the vessels of the skin in a state of efficient activity, and preserving or restoring the natural temperature of the surface. And, this point having been gained, very few and light bed-clothes are all that will be required ; the system, having been sufficiently exhausted of its vital energies by the day's work, will need no bed of down to lull or soothe it to repose ; and a hair mattress, a sheet, blanket, and counterpane, will generally suffice to defend the body from the ruder approaches of the cold air, even during sleep, and in the coldest of our wintry nights. Without such regular use of nature's opiates, the skin is easily chilled, and the body must be buried in a soft bed, and covered with heaps of bed-clothes ; and then re-action comes on, and the skin becomes hot, the system feverish, the sleep disturbed, and the man rises comparatively unrefreshed, and perhaps unable to prosecute his studies or his business. The system is perhaps relieved for the time by medicine ; until, too often so treated, the constitution becomes injured, or, it may be, eventually broken up. I would not be understood to advise, that the bed of feathers or of

down, and the three or four blankets, to which any one may have been accustomed, should be abandoned at once, without preparation, whatever the age, or the habits, or the ailments, of the individual. The doing so must be prepared for, by a regular diet, exercise in the open air, judicious clothing, &c.; and then, gradually, blanket after blanket may be safely, and without discomfort, dispensed with; and, last of all, the hair mattress may be put on the feather-bed, instead of the bed on the mattress.

But, however great may be the caution needful with regard to the debilitated adult, comparatively little of such caution will be found to be needful in the case of children, after the periods of infancy and earlier childhood shall have been passed. During the earlier periods of life, the young require much fostering means of protection and warmth; but this is very much less the case afterwards. I would, then, by good and active nursing, by daily exposure to the air and the light, by the liberal and daily application of tepid water (temperature 70 to 80 degrees) to the whole surface of the body, by keeping the stomach free from all trash, as sugar, &c., strive to regulate and give tone to the several functions; and it may be relied upon that no heating bed will such children require after the age of infancy, no multiplicity of bed-clothes will they need; and a hair mattress and few bed-clothes will suffice to keep up the heat of their surface, without irritating or weakening the system.

The two ways in which substances part with their

elevated temperature to the colder bodies around them, have been mentioned ; and the more important of these ways, that of the conduction of the heat from particle to particle of the colder atoms of the surrounding bodies, has been sufficiently taken notice of. Substances part with their heat to colder bodies, not only by *contact*, but in *rays*, proceeding from all points of their surface, in all directions. This is well known as radiated heat ; and the bodies are said to part with their heat by radiation. Not only, however, do different substances part with their heat in this way, with different degrees of quickness ; not only does the degree of quickness differ, as the heated substances are more or less thick, or as their surface is more or less rough ; but they part with their heat by radiation with different degrees of quickness, according to the colour of the surface, according to the ray or rays of light which the surface of the heated substance reflects. Little has been added to our knowledge of these facts, since the experiments and discoveries of the late Professor Leslie, made public in 1804 ; but the subject has been illustrated and confirmed by the experiments of Dr. Stark, of Edinburgh, published in the “*Philosophical Transactions*” for 1833. It may be enough to mention here, that *white* surfaces both radiate most slowly, and absorb radiant heat most slowly ; and that *black* surfaces, on the contrary, both radiate most quickly, and absorb radiant heat most quickly. In Dr. Stark’s experiments, the bulb of a delicate thermometer was successively surrounded by equal weights of differently

coloured wool, and placed in a glass tube, and heated, by immersion in hot water, to 180 degrees, and then cooled to 50 degrees, in cold water. The times of cooling were found to be, 21 minutes with the black wool, 26 minutes with the red wool, and 27 minutes with the white wool. Similar results were obtained, when the bulb of the thermometer was surrounded with flour of different colours. Moreover, differently coloured wools having been wound on the bulb of the thermometer, exposed in a glass tube to hot water, the mercury rose from 50 to 170 degrees in the following times:—when surrounded with black wool, in $4\frac{1}{2}$,—when with dark green wool, in 5,—when with scarlet wool, in $5\frac{1}{2}$,—and when with white wool, in 8 minutes.

The practical deductions from these facts are by no means unimportant. In hot weather, and more particularly in the intertropical countries, it may be desirable to wear clothes which will absorb as few of the sun's rays as possible; and white garments are shown to be the best calculated to answer this intention. Again, in cold weather, it is desirable to wear clothes which will part with as little as may be of the heat of the body by radiation; and white articles of clothing are proved to be the best in this instance likewise. The professional man, clad in black, is, strange to say, the most unphilosophically dressed; for in the summer, his clothes, by absorbing to a great extent the rays of the sun, render him much hotter; and in the winter, his clothes, carrying off by radiation much of his bodily heat, render him

much colder, than would clothes of any other colour. The delicate and the invalid should, then, generally prefer white, or light-coloured clothes, whether as summer or winter wear; and as winter clothing, the light-coloured great-coat is very much warmer than one of a darker hue. In very cold countries, the fur or hair of many animals, which are of a more or less dark colour in warmer regions, is often found to become quite white: one of the many wonderful instances of providential provision!

It is sometimes of importance in the sick-room and the nursery, to keep liquids warm as long as possible; and the colour, surface, and material of the vessels containing them, exercise considerable influence on the rate of cooling. Thus, if *polished* metal radiates as only 1, the same metal *tarnished* will radiate as about $2\frac{1}{2}$; while an earthenware vessel will radiate still more quickly. All vessels in which fluids are wished to be kept some time warm, ought to be made of metal, and the surface of the metal should be kept perfectly bright; or, what would be still better, as metals are good *conductors* of heat, and so part readily with their heat by contact, to have such vessels made of earthenware, and coated with highly polished metal. Earthenware being a bad conductor of heat, and the polished metal a bad radiator, liquids might be kept warm in such vessels, much longer than in vessels of any other kind.

CHAPTER VI.

On Bathing, Ablution, &c.—Uses of the Skin.—Action of the Cutaneous and Pulmonary Exhalations, in adapting the Human System to different degrees of Atmospheric Temperature.—Anatomical Structure of the Skin.—Effect of External Temperature on the Skin.—Effect of Immersion in Water of different Temperatures on the Skin, and on the System generally.—Bathing.—Dr. Currie's Case.—Swimming, Frictions, and Shampooing.—Use of the Bath, and its varieties in different countries.—Effects of an undue use of the Bath.—Best times for Bathing.—Salt-Water Bath.—Temperature, &c., of Sea-Water.—Sea-Water Bathing.—Hip-Bath.—Shower-Bath.—Affusion of Cold and Warm Water on the Body, locally and generally.—Sponging the Surface of the Body.—Strictures on Hydropathy.—Ioduretted and Nitro-Muriatic Acid Baths.—Cold Water recommended for the Habitual Ablutions.—Analogy of the effects of Hot and Cold Water when applied to the Skin, and when taken into the Stomach; and the inferences.—The Bathing and Ablution of Infants and Children.

“I VERILY believe,” writes the “Guardian,” in No. 102 of his admirable and standard essays, “a cold bath would be one of the most healthful exercises in the world, were it made use of in the education of youth. It would make their bodies more than proof to the injuries of time and the weather. It would be something like what the poet tells us of Achilles, whom his mother is said to have dipped, when he was a child, in the river Styx. The story adds, that this made him invulnerable all over, excepting that part which his mother held in her hand during

this immersion, and which by that means lost the benefit of these hardening waters." The story furnishes a truthful allegory, whether intended as such by the ancient poet or not.

I will venture to premise what has to be said on the physiological and hygienic effects of water applied to the surface of the body, as modified by local or general bathing, by ablution, and by sponging, and as modified by the physical condition of the individual, by some short account of the skin itself.

The skin is to be regarded, not only as a covering to the body,—as a protection to the softer, and more delicate, and more sensitive structures placed beneath it; but as being also intended to subserve many other offices of no less importance. One of the great uses of the skin has been already noticed—that of expelling a considerable portion of the residue of nutrition and digestion.

But, moreover, from being eminently a bad conductor of heat, the skin serves to maintain the elevated temperature of the body, by confining its heat,—and to prevent external heat, or external cold, from necessarily and at once destroying life. Protected by this power of resisting the passage of heat, human life is capable of surviving an exposure to very severe degrees of cold, and has been found to endure, with comparatively little inconvenience, very considerable degrees of elevated temperature. It is related in the "Memoirs of the French Academy of Science" (1764), that the young women, servants of a baker at Rochefoucault, were in the habit of

going into the heated ovens, in order to prepare them for the reception of the batch of dough to be baked ; and that, in some instances, they endured for twelve minutes, and without any material degree of inconvenience, the temperature of 278 degrees of Fahrenheit. The extraordinary statement has been fully borne out by more recent experiments of undeniable authority. In the "Philosophical Transactions for 1775," Sir Charles Blagden and other gentlemen found themselves able to remain, for an almost indefinite length of time, and without much inconvenience, in an apartment which was heated to a temperature above that of boiling water ; and for several minutes in the apartment when the temperature was at the great elevation of 260 degrees. If, in the case of the young women at Rochefoucault, they touched the sides of the oven,—or, in the experiments performed in this country, the gentlemen touched their watch chains,—or any other better conductor of heat than their articles of clothing, or the air of the atmosphere, they were immediately burnt, as might have been expected at such an elevation of temperature. The rarefaction of the air, the determination of the colder fluids from the interior of the body to the surface, the increased exhalation from the pulmonary and cutaneous tissues, and the non-conducting power of the bodily tissues, have all been suggested as means of explaining, or accounting for, the results of these very extraordinary experiments. According to the experiments performed, in the beginning of the present century, by Dr. Delaroche and Dr. Berger, in

which these gentlemen were exposed to the temperature of more than 225 degrees, and in which they subjected different animals to different degrees of heat, it seems to have been proved, that probably not more than half the proportion of oxygen of the air respired is consumed under such circumstances of exposure to a high temperature, as is expended by the respiratory process under ordinary circumstances. The supposition that the determination of the cooler fluids from the interior of the body to the pulmonary and cutaneous tissues, would serve to adjust the bodily heat to such extraordinary circumstances, must fall to the ground, when it is remembered that the length of time passed in so greatly heated an atmosphere, would have sufficed to subject all the blood in the body to the influence of the heated air in contact with the skin and respiratory tubes, many times over. The experiments of Dr. Delaroche, and more recent views and experiments, seem to show that this wonderful power of adaptation in the living animal system to such extremes of temperature, is mainly due to the cooling influence of the exhalations from the lungs and the skin; the degree of such exhalation varying, almost in an infinite degree, to suit different circumstances. If the observations of Dr. Southwood Smith, referred to in the preceding chapter, be remembered,—that a man who was working in a very hot place, was found to lose by exhalation no less than 5 pounds, 2 ounces, in the course of about an hour,—no difficulty will be felt in explaining, on this principle alone, a very great power

of adaptation on the part of the living system, to great extremes of heat; while the temperature of the blood may not be allowed, owing to the cooling influence of so much exhalation, to become more than a few degrees, and perhaps under no circumstances more than 12° higher than its natural temperature. At the same time, the non-conducting character of the tissues of the body may not be without some degree of influence, in enabling the body to resist sudden and great changes of temperature, before the increased secretion of the exhalants is able to exert its important effect in this respect. The belief in a large degree of influence in this matter being due to the non-conducting character of the skin itself, is much supported by the impunity with which the human system has been exposed to very low degrees of atmospherical temperature; in which cases, a much diminished degree of exhalation from the vessels of the surface would hardly suffice to explain the resistance of the system to the depressing and stagnating influence of an extreme degree of cold. Either owing to the skin acting as so bad a conductor of heat, or to diminished exhalation, or to the combined effect of several concurring causes, the human body has been exposed, without inconvenience, or without ultimate injury, to a temperature of 40° , or even more, below the zero of Fahrenheit's scale.

Supplied with a very large amount of nervous filaments, to endow it with sensation, the skin acts as the mind's great and watchful sentinel against

danger, and as the most ready and accurate informant on all points connected with external things; and the surface of the body becomes, consequently, a possible means of extreme physical suffering, and of material and direct injury to the sensorial functions; and, per contra, the skin affords a ready means by which the nervous system may be influenced, and either soothed, or excited, according to circumstances. Furnished with a very large supply of blood, to afford to its own substance the means of being continually renewed, to supply its secreting organs, and to keep up the energy and healthiness of the nerves, which are dependent on the due supply of blood, the skin has to be looked upon as an organ by influencing which, a very large quantity of blood may be suddenly thrown into the interior of the system, with corresponding engorgement of the viscera, and perhaps an irreparable degree of injury; or, as an organ, by determining or attracting the blood to which, the viscera and membranes of the interior may be proportionably relieved from undue pressure, or congestion, and perhaps enabled to resume the performance of the natural and necessary functions, which it is their business to discharge, and which such determination of blood to an internal organ, or such engorgement, might have interfered with or interrupted.

The skin, strictly so called, is covered by a much thinner layer, called the cuticle; a layer which may, without impropriety, be called inorganic, inasmuch as it is destitute of blood-vessels, nerves, and ab-

sorbents. It appears to be secreted from the outer surface of the subjacent tissue, in the form of a semi-fluid or viscid substance, which speedily loses the superfluous moisture, and becomes sufficiently hard to protect the sentient tissue beneath it from undue contact with external matter; while its thinness, and perfect flexibility, and adaptation to the surface, prevent it from interfering disadvantageously with sensation, or with the other functions and offices of the true skin. By friction, it becomes detached in the form of small scales; and its degree of re-production evidently depends on the degree of attrition of the surface of the body,—and it becomes very thick and hard, almost of horny character, in the soles of the feet of such poor pedestrians as have no shoes to protect the feet from the roads, and in the hands of many handicraftsmen. The cuticle is the thin membranous covering which is detached by blisters, burns, and other similar means of external injury or irritation. If the blister applied be of more severe character, or the surface of the individual be peculiarly sensitive to the influence of such an agent, a second membrane is often easily detached by means of a pair of forceps, or even of the fingers. It is sometimes advisable or necessary to effect the removal of this second tissue,—as when it is wished to promote a long-continued and purulent discharge from the vesicated surface. This second tissue is much thicker than that already spoken of; and is probably identical with a much more marked tissue, which is met with in the negro variety of the human

race. In the negro, this second tissue, called the mucous tissue, is the seat of the black colour of the skin; and in the different shades of colour or tint in the different varieties of the human family, it seems to be in this tissue that such colour resides. In minute structure, this, as its technical name, *rete mucosum*, implies, seems to consist of a fine and intricate network, through the meshes of which the excretion of the cuticle or epidermis is accomplished. The colouring matter or pigment of the *rete mucosum*, is deposited on its inner surface.

The corion, or true skin, consists of closely interlaced, minute, and dense fibres, more firmly compacted on the outer than on the inner surface. Its inner surface is marked by depressions, termed *areolæ*; but its outer surface is quite smooth, and so much more vascular, that after a successful injection of its vessels, it appears to be covered with a uniform net-work of minute vessels, infinitely subdivided, for the most part containing only colourless blood-globules, unless under circumstances of irritation or disease. This net-work is penetrated by the papillæ, which come into contact with the cuticle, and are the seat of the sense of touch. The papillæ are highly vascular and nervous in their structure. When the surface is chilled, the corion shrinks, whether from the diminished amount of blood contained in its vessels, or from a true contraction of its substance; whereas the papillæ either continue unchanged, or shrink less in proportion,—giving rise to what has been called *goose skin*.

Warmth first increases the action of the vessels of the skin, and causes a more considerable efflux of the perspirable matter; the skin is sensibly reddened; and, if the heat is increased in degree, inflammation, blistering, contraction, wrinkling of the tissue, and blackening, with disorganisation, may ensue. Cold at first stimulates the skin, and reddens it, from the excited action, and greater fulness of the capillary vessels. If continued, and the cold be sufficiently intense in its degree, the vessels contract, and the skin becomes pale,—and, if the cold is increased in its intensity, loss of feeling, and eventually death of the part, ensues. This account involves the supposition, that the surface of the body is surrounded with the air.

If the body is surrounded with water, the effect is somewhat different. When the system is in a state of vigour, and the surface is unchilled, the effect of immersion in warm water is much the same as that from a moderate degree of heat applied in other ways, excepting that the greater pressure on the surface must be allowed for, as well as the effect of the damp atmosphere respired, produced by the steam from the warm water of the bath; and the respiration is accordingly more laborious in its character, and in general the skin more actively pours out its secretions. It is indeed quite true that if the parts of the surface that are immersed in the water be subjected to friction, or if the trunk and limbs be moved about a good deal under the surface of the water, a corresponding proportion of the water of the bath is

found to be absorbed; but such absorption neither interferes with nor militates against an increased amount of secretion from the cutaneous exhalants. If the body is immersed in cold water, under the same circumstances of general vigour of the system, and an active surface-circulation, the first effect is a rapid chilling, obviously dependent on the fact that the water is so much better a conductor of heat than the air is. The degree of the chilling effect corresponds with the powers of the system, the previous heat of the body, the fulness or emptiness of the stomach, and the temperature of the water. In consequence of the effect produced by immersion in cold water on the temperature of the body, there is a great influence exerted on the circulation of the blood, and on the nervous system. The first effect of the cold water on the circulation is that the passage of the blood through the superficial vessels is checked; its secretions are possibly arrested altogether, and in all cases are largely diminished; and a correspondingly considerable proportion of the blood of the system is determined to the tissues and organs in the interior of the body. This may be ascribed to an extreme spasmodic action of the vessels of the skin, and the resulting interruption of their primary and secondary functions. If the water is not extraordinarily cold, and the powers of the heart and arteries are in full vigour, these are roused by the sudden rush of blood into them, to an unusual degree of effort; and the blood is driven back again to the vessels of the surface, and even in an unwonted

degree of volume and rapidity ; the warmth of the surface is regained ; and re-action is said to have taken place. This restored equilibrium of the circulation will continue to obtain during a longer or shorter time, according to circumstances ; and at length, if the immersion in the cold water is continued, the energies of the circulating organs become no longer able to counteract the cooling effects of so good a conductor of heat as the water ; they are no longer able to dispose of the quantity of blood which the rapidly refrigerating effect of the water on the surface is continually throwing back upon them ; they become more and more loaded with blood ; their action becomes gradually more oppressed and less energetic ; the skin is once more chilled, and its circulation is once again languid ; and shivering, loss of feeling, stupor, and, the cause still continuing, death ensues.

Besides this effect of immersion in cold water on the superficial and general circulation, there is an undoubted and simultaneous effect produced by it on the nervous system, the character of which is sufficiently understood by the word *shock*. This effect is depressing, and is of the same kind as results from any severe or sudden sensations, although it may be greater or less in its degree. The influence of a shock to the nervous organism, from extensive injury, or very violent impressions on the organic sensibilities, may be so great as to destroy life, without affording time for the action of any lesion, or the disturbance of any function, to contribute in any

degree to the fatal result. Although in the case of immersion in cold water, the severity of the shock may be rarely sufficient to act singly in producing any serious or lasting impression on the system, it may be admitted that it will contribute in an important degree to the bad consequences of the derangement of the general circulation of the blood, and the general derangement of the system, in cases where general debility, or general congestion, or a disordered condition of any of the great or vital organs, serves to interfere with, or prevent, the prompt supervention of such a degree of re-action as may serve to restore the balance and equilibrium of the circulation, to relieve the engorgement of the internal organs, and to secure a vigorous action of the blood-vessels of the skin.

Certain conditions are more or less necessary, in order to render re-action prompt, efficient, and secure, in the case of immersion in cold water.

1st. A due adaptation of the temperature of the water to the circumstances of the case. There are few persons who can bathe with perfect safety in water of a lower temperature than 60 degrees. The heat of the human body being generally about 98 degrees, an immersion in water of the temperature of 80 degrees will usually feel at first somewhat cold to the bather. The degree to which this sense of coldness is felt on immersion in water of a given temperature, will depend very much on the temperature of the air. Water of the same heat will seem much warmer to the bather in winter

than in summer time. Provided a sufficiently prompt and an efficient degree of re-action is established, and provided there is no organ or function in such a state as to be impaired by the influx of blood determined at the instant of immersion to the internal parts of the body, the colder the water of the bath, within certain bounds, the greater and more genial will be the degree of re-action.

2nd. The colder the water of the bath, the shorter, other things being equal, should be the period of the immersion. It is seldom prudent to remain longer than ten minutes in a cold bath; and this may prove to be much too long an immersion for an invalid, who might be justified in using the cold bath for a shorter period.

3rd. The effect of the cold bath on the system varies according to the degree of energy with which the heart and arteries are acting at the time of using it. There can hardly be a more dangerous step, than to make use of the cold bath when the body is fatigued,—whether from excessive muscular exertion, or from heat, or from long continued mental exertion, or from loss of sleep, or however else brought about. In this case, the re-action may be imperfect, or only partial; and shiverings and great prostration of strength may be followed by local determination of blood, and febrile or inflammatory conditions. This may be well illustrated by the case of the late Dr. Currie, as recorded by himself in his admirable “Medical Reports.” “On the first of September, 1778, two students of medicine at Edinburgh set out on foot on a journey, a considerable part of which

lay along one of the rivers of Scotland (the Tweed ; —the journey having been from Edinburgh to Moffat). They started by sun-rise, and proceeded with alacrity in the cool of the morning. At the end of eight miles they breakfasted, rested for an hour, and then resumed their journey. The day grew warm as it advanced, and after a march of eight miles more, they arrived, heated, but not fatigued, on the banks of the river above-mentioned, about eleven in the forenoon. Urged by the fervour of the day, and tempted by the beauty of the stream, they stripped instantly, and threw themselves into the river. The utmost refreshment followed ; and when they retired to the neighbouring inn, this was succeeded by a disposition to sleep, which they indulged. In the afternoon they proceeded, and, travelling sixteen miles farther at a single stretch, arrived at the inn where they were to sleep, a little after sunset. The afternoon had been warm, and they perspired profusely ; but the evening was rather temperate and cool. They had travelled for some miles slowly, and arrived at the end of their journey stiffened and wearied with their exercise. The refreshment which they had experienced in the morning from bathing induced, however, one of them to repeat the experiment, and he went perfectly cool into the same river, expecting to relax his limbs in the water, and afterwards to enjoy profound sleep. The consequences were very different. The Tweed, which was so refreshing in the morning, now felt extremely cold, and he left the water hastily. No genial glow succeeded, but a

feverish chill remained for some time, with small, frequent pulse, and flying pains over the body. Warm liquids and friction brought on, at length, considerable heat, and towards morning perspiration and sleep followed. Next day, about noon, they proceeded on foot, but the traveller who had bathed was extremely feeble; and though they had to perform a journey of a single stage only, as some part of it was difficult and mountainous, he was obliged to take the assistance of a carriage which overtook them on the road. It was several days before he recovered his usual vigour. This relation will not, I hope, be deemed of the less authority because it is given by the person who suffered by his imprudence.”

4th. The effect of immersion in cold water varies according to the heat of the skin, and the vigour of the cutaneous circulation, at the time of bathing. The hotter the skin, and the greater the vigour of its circulation, the more safe is the use of the cold bath. This, however, supposes the heat and active condition of the vessels of the skin to be caused, not merely by the sun's rays, or any similar external irritant or excitant, but to be produced by an energetic action of the heart and arteries; and the hotter the surface of the body under such circumstances, the more prompt and efficient the re-action. It is, therefore, not well to stand any long time after undressing, before plunging into the water. Such a practice chills the body very much more; and in many cases, renders the use of the cold bath absolutely unsafe, when it would be otherwise profitable and advantageous.

It was on this principle, that the use of cold water to the surface of the body generally, either by immersion, affusion, or sponging, was so strongly recommended by Dr. Currie, in fevers and many other diseases, chiefly characterised by general excitement of the vascular system, and an undue heat of the skin. And the reason of this great agent having been used so comparatively seldom, or in so much modified a degree, in the treatment of such cases, is to be found in the generally complicated character which they present, being mixed up with undue determination of blood to, if not a congestive or inflammatory condition of some of the great internal and vital organs; when the risk of increasing such determination of blood, or aggravating such congestion or inflammation, by the action of cold water on the surface of the body, may well be feared to be greater, than the probable advantage derivable from lowering the febrile temperature, moderating the vascular excitement, and promoting the eventual efflux of the cutaneous secretions. Yet, when not contra-indicated by any considerable degree of organic congestion, or more marked vascular determination to some of the great organs, the external application of cold water, generally or locally, is one of the most energetic and trustworthy of remedial resources in the early stages of fever, and febrile complaints in general, and one that is apt to be too little attended to.

5th. The effect of immersion in cold water varies according to the fulness or emptiness of the stomach; according to the period at which the digestion of the

aliment may have arrived; and according to the healthiness and power of the digestive organs. It has been said before, that the stomach during digestion, and particularly during the first stages of digestion, is supplied with a very large quantity of blood. So large a quantity of blood being directed to the stomach at such times, the whole energies of the heart and arteries are not at immediate command, to meet the effect of the cold bath; diverted by the demands of the stomach, and those of the skin and system generally, re-action is less prompt, and less perfect in its degree; and a risk is incurred of more or less serious disease.

6th. The effect of immersion in cold water varies according to the state of the mind. Mental exhaustion and bodily languor are generally concomitants; mental irritability and undue physical sensitiveness generally obtain at the same time; mental torpidity and vascular sluggishness are generally attendants on one another; and they would equally contra-indicate the use of the cold bath, without a very careful consideration, and an anxious watchfulness. In general, under such circumstances, the use of the tepid or warm bath, is to be preferred; and often proves to be a very influential remedial measure.

Too much can hardly be said of the value of muscular exercise, and friction of the skin, while the person is in the bath. Swimming calls into action almost every muscle of the body, and hence it is valuable as a kind of exercise; and in the same proportion does it assist the action of the heart and

arteries, diminish the risk of congestion, and determine the blood to the vessels of the surface; and by thus equalising the distribution of the blood, it promotes and maintains re-action, and lessens the chance of an undue depression of the nervous energies. When swimming cannot be practised, or from circumstances would not be justifiable, its place should be supplied, as far as possible, by constant exercise of the muscles of the trunk and extremities, as long as the individual remains in the water. In some cases, general frictions of the surface, and kneading the muscles well with the fingers, may be useful as auxiliaries, or even as substitutes, for the more active exercises, while the person is in the bath.

The action of the warm bath is essentially very different from that of the cold bath; and their effects may be conveniently considered together, for the sake of comparison. The immediate effect of the warm bath (temperature 95° to 100°), is to promote the secretion from the skin, and probably from the lungs; to determine the blood to the cutaneous and mucous tissues; and according to the greater or less heat of the water, and the length of time during which the person remains in the bath, to diminish or excite the power and quickness of the circulation. The tepid bath, if the individual remains only a few minutes in the water, will be usually found to act as a stimulus to the nervous and vascular systems for some hours afterwards. The warm bath, on the other hand, if the individual remain half an hour or longer in the water, has decidedly a lowering and depressing effect

on the system generally,—relaxing the tissues, lessening the force and frequency of the heart's action, and exhausting considerably the nervous energies. The immediate effect of the cold bath, if adjusted as to its temperature to the power and condition of the system, and attended with immediate and full re-action, and not remained in too long, is decidedly that of a stimulant to the nervous and vascular systems; and therefore to all the mental faculties and bodily functions. The stimulating effect lasts for many hours afterwards. The effect of the undue use of baths of any temperature,—either remaining in the bath too long at a time, or bathing too often, so frequently as to be disproportioned to the strength of the system, or to the season, climate, &c.,—is always what might be expected from an agent which promotes the action of the emulgent organs generally, and stimulates only for a time, but in general to a considerable degree, the economy of the system: the undue use of the bath is always followed by much debility; and accordingly this great means of health, and great agent in the relief or cure of disease, should be had recourse to with discretion, and never practised without due care. Debilitating results are necessarily more likely to follow the undue use of the warm than of the cold bath; and perhaps more likely, the higher the temperature of the bath, supposing that a perfect degree of re-action attends the use of the bath at the lower degrees of temperature.

The climate, and the season of the year, have much to do with the degree to which baths of any temperature may be used advantageously. In the

warmer climates, and in summer time, the regular use of the bath is much better borne, and proves to be at once more necessary and advantageous, than in colder countries, or the winter season. Generally speaking, it will perhaps be found, that the greater the difference between the temperature of the summer and the winter, the more necessary and the better borne will the use of the bath usually be. Although, however, in the warmer climates and seasons generally, the use of the bath is more strongly indicated and better borne,—in extremely hot climates and seasons, the greatly increased action of the cutaneous exhalations must be duly allowed for, and the consequently relaxed condition of the general system, and of the cutaneous and mucous tissues in particular,—together with the increased susceptibilities of these tissues to every influence that may derange their functions. And it seems that, under these circumstances, the use of the bath, in the sense in which it is commonly regarded in this country, is much less practised habitually in the East than may be usually supposed. In Turkey, it is said, the so-called bath is virtually an apartment that is warmed to any required degree of heat, by means of flues, which pass round and across the building, and the individual is said to go very seldom into warm water. The reputed bather walks into the heated apartment, where he is washed, dried, well rubbed, and anointed; remaining in the bath-apartment half an hour in winter, and a quarter of an hour in summer. At certain intervals of time, the use of a warm water bath is prescribed to both the men and women of

Turkey, by the laws; but this is evidently rather a question of cleanliness than anything else. In Egypt, too, according to Mr. Lane*, the bath seems to be only a vapour bath. The bath-apartment is filled with steam arising from a tank or tanks of warm water. "The bather, having entered the *hararah*, soon perspires profusely, from the humid heat which is produced by the hot water of the tanks and fountain, and by the boiler. The operator of the bath, who is called 'mukeyyisátee,' immediately comes to him. If the bather be covered with more than one napkin, the mukeyyisátee takes them off, and gives him a wet *maḥzam*; or the former *maḥzam* is retained and wetted. The bather sits on the marble seat of the *faskeeyeh*, or lies upon a napkin on one of the *leewáns*, or by the edge of one of the tanks, to submit to the first operation, which is that of cracking his joints. The operator cracks (pulls and produces a kind of cracking sound from) almost every joint of his frame: he wrings the body, first one way, and then the other, to make several of the *vertebræ* crack: even the neck is made to crack twice, by wrenching the head round, each way, which produces a sensation rather alarming to an inexperienced person (there must be a good deal of trick and little advantage in this); and each ear is generally twisted round until it cracks: the limbs are wrested with apparent violence; but with such skill, that an untoward accident in this operation is never heard

* "An Account of the Manners and Customs of the Modern Egyptians." By Edward William Lane.

of. The main object of this process is to render the joints supple. The mukeyyisátee also kneads the bather's flesh. After this, or previously, he rubs the soles of his feet with a kind of rasp, of baked clay. There are two kinds of rasps used for this purpose: one is very porous and rough; and its rasping surface is scored with several lines: the other is of a fine close clay; and the surface with which the rubbing is performed is rendered rough artificially: both are of a dark, blackish colour. Those which are used by ladies are generally encased (the lower, or rasping surface of course excepted) in thin, embossed silver. The rougher rasp is of indispensable utility to persons who do not wear stockings; which is the case with most of the inhabitants of Egypt: the other is for the more delicate; and is often used for rubbing the limbs, to render the skin smooth. The next operation is that of rubbing the bather's flesh with a small, coarse, woollen bag. This done, the bather, *if he please*, dips himself in one of the tanks. He is next taken to a hanafecyeh. A napkin having been hung before the entrance to this, the mukeyyisátee lathers the bather with 'leef' (or fibres of the palm-tree) and soap and sweet water, which last is brought in a copper vessel, and warmed in one of the tanks; for the water of the hanafecyeh is from a well, somewhat brackish, and consequently not fit for washing with soap. The leef is employed in the same manner as sponge is by us: it is not of the kind produced by the palm-trees of Egypt which is of a brown colour: that used in the hammám is white, and is brought

from Hejáz. The mukeyyisátee washes off the soap with water from the hanafeeyeh; and, if required, shaves the bather's arm-pits: he then goes, leaving him to finish washing, &c. The latter then calls for a set of napkins, four in number, and having covered himself in the same manner as before described, returns to the beyt-owwal. In the beyt-owwal, a mattress is spread for the bather, covered with napkins, and having one or two cushions at one end. On this he reclines, sipping a cup or two of coffee, and smoking, while a láwingee rubs the soles of his feet, and kneads his body and limbs. He generally remains half an hour, or an hour, smoking his shibuk: then dresses, and goes out. Many persons go to the bath twice a week: others, once a week, or less frequently. The women who can afford to do so, visit the hammám frequently; but not so often as the men." In the clever and racy "Letters of Lady Mary Wortley Montagu," likewise, we learn that "they (the Turkish ladies) generally take this diversion (the bath) once a week;" and from these celebrated letters, it is evident that the immersion in warm water is very secondary to the remaining four or five hours, exposed in a state of nudity to a heated atmosphere, some of the bath-apartments being charged with steam, and others with warm air only. In India, the bather is said to be laid on a board, and warm water poured over him; his body is rubbed, his joints made to crack, his muscles kneaded, and the whole means comprehended in the word shampooing are practised; and all this is followed by hard

rubbing with a hair-glove, and frequently by the inunction of oil over the whole surface of the body. In Russia, the bath-apartment is filled with a dense steam, by pouring water on heated stones ; and the temperature of the apartment is said to be raised to 122° , or in some instances even to 133° of Fahrenheit ;—the surface is then well percussed with a leafy branch, or some similar soft but firm material ; and then rubbed with soap ; and then the bather has tepid water poured over him ;—and, lastly, several buckets-full of cold water are dashed over him ; or otherwise he quits the vapour-bath to plunge into a river, or to roll himself in the snow. The surface of the body being so much heated and excited, and the heart's action in full vigour, the contrast of a cold temperature so immediately succeeding the heated vapour, is said to be much less ungrateful to the feelings than might have been expected,—the re-action being immediate, and to the fullest extent. These baths are said to be frequently had recourse to by the inhabitants of Russia, and of some others of the colder European countries ; but it is probable that they are by no means, or in very few cases, made use of daily, or oftener than once or twice a week. In these days, when hydropathy, with its quackish excesses,—and the frequent inculcation of physiological facts and inferences on the minds of the people,—and the general establishment of admirable public baths and wash-houses in many of the larger towns,—may possibly lead to an excessive use of baths, and encourage an opinion that bathing can hardly be too frequently or

too much practised, I have thought it needful to show, that neither the customs of different nations, in the countries where the use of the bath has been notoriously the most practised, nor sound principles derived from an observation of the effects of bathing on the human system, serve to justify a daily practice of immersion in water, of any temperature whatever, in the generality of cases.

As to the period of the day, on which a cold, tepid, or warm bath, may be most advantageously taken, there is no doubt that a bath of any kind should, in very few cases, be made use of after dinner. If taken within one, or two, or three hours, after the dinner, there is considerable risk that the bath will interfere with the processes of digestion; and at the same time, that the digestive processes may interfere with the due maintenance of the superficial circulation, temperature, &c., which is so important after the use of the bath;—and if taken at a longer period after the dinner, there is a risk lest the system having become unduly fatigued by the labours of the day, or the need of sleep, on the one hand; or lest the sleep following too soon after the bath, on the other hand; may interfere with the re-action, or render the sleep unrefreshing, or the system feverish. In most cases, the bath should be used either before breakfast, or about three hours after breakfast; or at all events, there should be an hour between the bath and dinner time. In the case of the more delicate, bathing is found to be better borne about three hours after breakfast.

The use of the vapour bath has been alluded to, in the instance of the Russians and Egyptians; and it is a valuable and excellent means of applying heat to the surface. It seems that a much higher temperature can be borne without discomfort in the vapour bath, than when the body is immersed in warm water. The temperature of a hot bath cannot be higher than about 113° , without discomfort, and a risk of much subsequent irritation of the surface, and consequent feverishness and general derangement of the economy; whereas it is said the inhabitants of Finland sometimes remain more than half an hour in a vapour bath, at a heat of 167° of Fahrenheit. Dr. Kilgour says, that "the weight lost by perspiration, in a vapour bath, is much less than that lost in a hot water bath of much lower temperature. Berger found, on weighing himself, four minutes and a half after quitting a vapour bath, at 122° Fahrenheit, in which he had remained twelve minutes and a half, that he had lost ten ounces and one grain; but Lemonnier found that, after remaining about eight minutes in a water bath at 113° Fahrenheit, he had lost twenty ounces." The less degree of exhalation, and consequent exhaustion, produced by the vapour bath, may often be a sufficient reason for preferring its use to that of the warm water bath; and the greater temperature that is borne without inconvenience in the use of the vapour bath, appears to make it more useful in some cases, and particularly in some cutaneous affections, than the warm water bath.

The effect of the water bath may be considerably

modified by the addition of salt, &c.,—or if only part of the surface be immersed in the water,—or if the water be poured over the body, as in the shower-bath.

The effect produced by the addition of salt to the water of the bath, is very important and considerable. It assists and promotes re-action to a great extent; and hence many weakly and invalided persons can bathe advantageously in sea-water, who cannot bathe with safety in fresh water. Hence, in cases of dyspepsia and debility, it is usually advisable to add salt to the water of the bath: about half a stone of common salt to the ordinary sized bath, will be found to be usually an average quantity for this purpose.

The remarkable uniformity of the temperature of the ocean, peculiarly fits it for use as a cold bath;* independently of the great advantages offered by its saline constitution, to the promptness and degree of the re-action; conjoined as these are, moreover, with the advantage of breathing at the same time the peculiarly stimulating atmosphere of the sea-coast, which exercises so beneficial an effect on many disordered conditions of the system. Warm baths of sea-water are often of much service, in cases that are

* At a sufficient distance from the land, in the temperate latitudes, the temperature of the ocean is probably seldom below 45°, or above 70°; exhibiting extremes of temperature only amounting to 25°;—the temperature of the land in the same latitudes often varying as much as 100°, at different periods of the year. The mean temperature of the ocean within the tropics, is said to be about 80°: a temperature which varies but little at different periods.

marked by a greater degree of combined sensitiveness and debility, than would justify bathing in the open sea.

If only part of the body is immersed in the bath, the effect produced on the system is, of course, much less considerable. But such partial bathing is not found to be of much service under ordinary circumstances. The use of the hip-bath, which may be included under this head, is perhaps the most important and valuable form of partial or local bathing. In this case, the hips, lower part of the back, and the abdomen, are immersed in the water, which is of any required temperature,—the lower extremities and upper parts of the body being out of the water. In many cases of irritation, and of spasm, and of visceral obstruction, even of inflammatory character, affecting the gastro-intestinal tissues, the liver, kidneys, bladder, &c., the warm or tepid hip-bath has proved a useful auxiliary to the more active treatment, and one that may be had readily, and almost as soon as suggested, in the poorest person's house: a common washing tub answering every purpose required; and a sufficient supply of warm water being obtainable from the boiler of the common kitchen-range, or even from two or three kettles or pans full of boiling water. In many cases of local debility affecting the female system, the regular use of the cold water hip-bath, for a single instant's immersion, or longer, according to circumstances, every day, has proved to be of efficient service. The more or less regular use of the hip-bath, of a temperature that is determined by the individual cir-

circumstances of the case, deserves to be considered to be of general importance to females of all ages. The period of the day at which it should be used, must be determined by circumstances.

If the water is poured over the body, either partially or generally, the effect is very different from that of immersing the body in the water.

The shower-bath seems to chill even more than a plunge-bath of the same temperature; but in most cases, re-action takes place much more quickly from the use of the former than the latter. This may be often a sufficient reason for preferring the use of the shower-bath to that of a plunge-bath. The shower-bath affords a very convenient mode of bathing,—and one that is readily introduced into any house; but, as a remedial agent, it is seldom to be compared in its effects with bathing by immersion. In many cases of head-affection, however, the shower-bath is deservedly preferred to the plunge-bath. The temperature of the shower-bath may range from the ordinary temperature of the water, to that of 65°, 75°, or 85°, or even warmer. The quantity of water used at a time, usually ranges from four to ten gallons. Two, four, or six pounds of salt, may be dissolved in the water, if required.

The affusion of water, of any required temperature, and in any desired quantity, over the whole of the body, or any part of it that may be indicated, constitutes a very powerful and important remedial agent. In many cases of undue determination of blood to the head, with or without vascular excitement, or marked

phlogistic symptoms, the cold affusion of a prescribed number of gallons of water, allowed to fall on the head, which may be held over the side of the bed, over a wide and large vessel to collect the water,—the effect being increased when necessary, by pouring the water from a greater height,—may be justifiably regarded as one of the most efficient means we possess of relieving such a condition. I may mention that I have by this means succeeded in producing an absolute state of syncope, in a case where phlebotomy, carried to an unusually large extent, had produced no perceptible influence whatever on the character of the circulation. In many cases of spinal debility, with or without curvature, the affusion of cold salt and water down the spine,—which is easily managed without occasioning any uncomfortable wetting of the room, by directing the patient to sit on a stool that is a little higher than a tub, over which the lower part of the back projects, so that the water poured down the back may run into the tub,—forms a remedial measure of inestimable value. In many cases of local injuries, and imperfect use of a limb or joint, the consequence of dislocation, or fracture, or sprain, or severe bruise, the local affusion of cold water, or cold salt and water, has been proved to be of the greatest service. This is best managed by means of a double-action force-pump, constructed on the principle of the garden-engine; to which a pipe and nozzle of any required diameter is attached. By an apparatus of this kind, a stream of water of any desired calibre,

and impelled with any required force, may be directed against any part of the body.

Sponging the surface of the body generally, or the head, or the back, with cold or tepid water, is another and valuable means of influencing the system through the medium of the skin, and of maintaining a healthy condition of the skin itself. The re-action from this should be prompt and of marked degree, or the practice is usually found to be unsuited to the habit of body, or the condition of the system.

There are some people, undoubtedly, who are of too feeble a habit, to bear even the habitual use of cold or tepid water to the whole surface of the body, by means of the sponge; there are, moreover, persons in whom the oleaginous secretion of the skin, obviously intended to protect the surface in some degree from cold or other sources of irritation, is not produced in adequate proportion to suffer its daily removal without some degree of disadvantage. In such cases, dry friction may be usefully substituted for the sponging, either by means of a coarse cloth, or the flesh-brush, or the hair-gloves, according to the delicacy and sensitiveness of the skin; and the inunction of a small quantity of oil after such friction,—a practice so commonly followed after the use of the bath in many of the oriental countries,—might be attended with much comfort and advantage. Friction, indeed, is, even alone, or without the use of water in any way, an admirable means of giving vigour, activity, and tone to the vessels of the skin; and friction of the surface often proves to be

a most efficient remedy in cases of lingering debility, or protracted convalescence, or where, as in spinal cases, muscular exercise is not to be obtained, or not to be obtained to an adequate degree. And as an adjunct to the use of the plunge-bath, the shower-bath, or sponging the surface with cold or tepid water, friction is invaluable; every bather ought to resort to it invariably, as a means of accelerating the re-action, and increasing it in degree: the towels with which he dries his skin can hardly be too rough.

Of some other ways in which water has been applied to the surface of the body with hygienic or remedial intentions, a few words may prove to be sufficient notice. The surrounding the body with a wet sheet, covering this immediately with blankets, or other efficient non-conductors of heat, by which means the whole becomes, by the confined heat of the body, converted into a vapour bath,—which is maintained in action for any required length of time,—and followed or not by immersion in a shallow vessel of cold or of tepid water,—the whole operation being repeated daily, or oftener, or more seldom, as may be directed,—appears to be a somewhat uncertain way of obtaining an efficient vapour bath, and a less efficient mode of procuring the results that are obtained in the Russian system of bathing, heretofore described, by following the use of the vapour bath by dashes of cold water over the body. I beg to repeat, that the much-vaunted wet-sheet and its appurtenances, of the hydropathists,—and all the parapher-

nalialia of shallow tubs for the subsequent immersions, and other intricate contrivances,—are neither more nor less than a doubtfully efficient mode of obtaining a vapour bath, and an uncertain means of obtaining those results which the Russian mode of bathing obtains in so full a degree; while the apparent simplicity of the means used, and the comfortable sensations produced by the use of the wet sheet, &c., involves the great risk of the adoption of the plan in cases that are by no means adapted to the use of the vapour bath, or of cold or tepid immersion,—as well as the risk that must ever be incurred by the daily use of any bath whatever in lengthened courses, even in cases of health and unimpaired strength of system,—and, *à fortiori*, in cases of debility or disease.

The addition of iodine, or the iodides of potash, &c., to the water used as baths, in many cases of disordered health,—as well as the addition of the mixture of nitric and muriatic acids to the baths ordered in other cases,—deserve to be mentioned as important remedial measures, which seem to be seldom thought of, and which may be affirmed to be means of no doubtful or secondary character. As to the strength of the ioduretted baths, too much care can hardly be exercised. M. Lugol found that a proportion of six drachms of hydriodate of potash and three draehms of iodine to a bath containing 240 quarts of water, often produced much redness of the skin, sometimes a considerable degree of irritation, and occasionally so much cutaneous excitement,

as to be unbearable by the feelings of the bather. This is the more extraordinary, as M. Lugol has administered internally, stronger solutions of iodine and hydriodate of potash than the above formula represents. It would be difficult to commence the trial of this great alterative agent, in any case, in the form of baths, in too diluted a form,—gradually increasing the strength of the bath, according to circumstances, by the addition of more iodine and hydriodate of potash, in the proportion of one part of iodine to two parts of hydriodate of potash. It is necessary to be known that the trough used for the ioduretted baths should be made of wood. As to the strength of the nitro-muriatic acid bath, which undoubtedly acts on the system by virtue of the free chlorine disengaged, and which acts in so marked a degree on the hepatic functions as to merit the frequent consideration and suggestion of the profession, a pediluvium containing an ounce of the strong muriatic acid, and an ounce of the strong nitric acid of the shops, and four gallons of water, in which the feet and ankles may be immersed, and continued for fifteen or twenty minutes, the parietes of the abdomen, the back, and the legs, being well sponged and rubbed therewith, will be usually sufficiently strong. If this should not prove to be efficacious, one ounce and a half of each of the acids may be added to the four gallons of water. In severer cases, where a general bath for the immersion of the whole body may be desirable, it would be well to make trial, in the first instance, of a still weaker solution of the

mixed acids than the first of these formulæ: say, to a bath containing sixty gallons of water, seven ounces of each of the acids might be added at the first. Of course great care must be taken to mix the acids carefully with the water, before the person enters the bath; and in these and all other medicated baths, the importance of steady and vigorous friction of the surface of the body during the period of immersion, should be especially remembered,—in order to secure, as far as possible, the absorption of the medicinal agent into the system.

Before concluding the subject of bathing and ablution, I should animadvert on the practice, in which many people unthinkingly indulge, of washing themselves, particularly during the winter months, in warm water. There are few habits which so much predispose the system to suffer from the effects of cold. I have traced many cases of frequent sore-throat to this practice alone; and their recurrence has been prevented by simply washing the face and neck with cold, instead of warm water.

There is a sufficiently remarkable analogy between the effects of water on the system when taken into the stomach, and those produced by it when it is used as a bath; and the mention of some points on which this analogy appears the most strongly, may prove to be useful.

The use of the hot bath proves to be stimulating to the vessels of the skin in the first instance; but the degree of cutaneous or general vascular excitement occasioned by it, is easily lowered by any

depressing influence,—as cold, or damp. The same is true with regard to hot water, when used as a drink. It stimulates the stomach in a very decided manner; but the stimulating effect soon passes off, and is followed by more or less of languor and exhaustion of the stomach's powers. The hot bath, if used habitually, weakens the powers of the skin—the tone of its vessels. So in the stomach, hot water, when used habitually as a drink, materially and seriously impairs its energies. On the other hand, the use of the cold bath, or sponging the surface of the body with cold water, if not had recourse to unduly, gives strength to the vessels of the skin, and energy and equability to its functions. So in the stomach, the use of cold water as a drink, if not excessive, acts as an undoubted tonic: one that, if used at proper times, and with proper precautions, is a valuable remedy. The intemperate use of the cold bath, and the intemperate use of cold water internally, must be equally debilitating in its effects on the system, and equally an unwise source of expenditure to the economy.

When the energies of the body have been exhausted, no matter how, it has been shown that the cold bath generally acts injuriously on the system; depressing the vascular condition of the skin to an extent which the heart and arteries are not in a state of sufficiently vigorous action to counteract. So in the stomach, in a similar state of system, when the bodily powers are exhausted, copious draughts of cold water are often highly detrimental, and have

even destroyed life ; for it should be recollected, as an additional reason for information and caution on this subject, that if a man plunges into cold water when in a state of fatigue, and thus unduly chills the surface, and depresses the powers of life, heat may be at once applied to the skin, frictions may be used to any extent,—means of at least partially counteracting the bad effects, are at hand and applicable ; but if the powers of the stomach are unduly depressed by the internal use of cold water, the energies of the viscus are not so easily restored ; and although there is little doubt that few better means could be adopted under such circumstances, than the application of heat over the region of the stomach, and friction over the general surface of the body, the effect of such means must be less immediate in their operation, and less certain to be beneficial, than in the other case ; and the instance of Dr. Currie which has been cited in this Chapter, shows conclusively, that, even in the case of the unwise application of cold to the surface of the body, the effect of remedies may be by no means prompt or satisfactory.

Even when the surface of the body is unduly heated, the use of the cold bath may not be contraindicated, provided that the powers of the system are not weakened, and the heart and arteries are acting with full and proportional vigour. So, even although the body is heated, cold water may be drunk without risk, if the bodily powers are in full and vigorous action.

Lastly, as has been said before, where the powers of the system are so far comparatively exhausted, that the cutaneous circulation would be injuriously interfered with by immersion in cold water, sponging with cold water may prove to be really beneficial in its effects. So in the stomach, when the system is in such an exhausted condition, that a copious draught of cold water might seriously depress, and perhaps sink, the powers of life, sipping cold water slowly,—taking it by degrees, and a little at a time, into the stomach,—is usually an excellent means of aiding the restoration of the tone and the powers.

I have still to say a few words, as to the bathing and ablution of infants and children. It must be borne in mind, how delicate, and highly vascular and extremely susceptible to all impressions, the skin is in infancy; and not only so, but that the mean temperature of infants was shown by the observations of Dr. Edwards, to be only between 94 and 95 degrees; whereas that of adults is 98 degrees. In more delicate infants, according to those observations, the mean temperature may be inferred to be considerably lower, and possibly below 90 degrees. Connecting the circumstances of thinness of texture, great vascularity, high susceptibility, and an essentially feeble and easily depressed circulation, with the lower medium temperature of the body in infancy, the importance of the use of tepid or even warm water for their baths and ablutions becomes very evident. The only exceptions to this rule, might be the instances of very strong and well developed infants, who are unavoidably

exposed to an extremely cold atmospheric temperature ; but such exceptions should be admitted with caution. In general, so susceptible, and so feeble, is the circulation in infancy, that not only should the habitual use of warm water for the baths and ablutions be inculcated on the minds of mothers and nurses ; but even exposure to the colder weather of the winter and spring months, may be justifiably avoided in this country, provided that the house is large enough, and sufficiently well ventilated, to secure to the baby a due change of air, and a sufficiently pure air, without the necessity of leaving the house.

In the earlier years of childhood, the warm or tepid water should be gradually exchanged for cold water, at least for the purpose of the habitual ablutions. The unavoidable exposure of children to the cold air, and the desirableness of out-of-doors exercise for them ; and their frequent alternations of active exercise, and correspondingly heated systems, with quiet, and corresponding risk of chill, which must have been noticed by all who have observed the games and sports of childhood ; point out very clearly the advantage of using cold water for the ablution of children, after the age of infancy.

CHAPTER VII.

On Mineral Waters.—Distinctive Character of Mineral Waters.—Therapeutic Importance of Mineral Waters.—Chemical Character of their Respective Mineral Impregnations.—Classification of Mineral Waters : Saline, Sulphureous, Carbonated or Alkaline, and Chalybeate.—Thermal Mineral Waters.—Principal Mineral Waters of Great Britain and Continental Europe.—The Mineral Waters of England considered in further detail, as to their Localities, the Chemical Nature of their Saline and Gaseous Impregnation, and their Therapeutic Effects : Buxton, Matlock, Bakewell, Bath, Bristol, Cheltenham, Leamington, Tunbridge-Wells, Harrogate, &c.—Stimulating Effects of the several Mineral Waters.—Inferential Suggestions as to the Medicinal Treatment of Chronic Diseases.

MINERAL waters act remedially on many of the disordered conditions of the human body, particularly on those which are of chronic character, or in a chronic stage ; they assist efficiently, in many cases, the therapeutic effects of climate and change of air, and the other means which have been considered in the preceding Chapters ; and they often exercise a marked curative influence on morbid states of the system, which other means have failed to relieve, even when aided by the appliances of medicine. The mineral waters deservedly occupy an important position among the means of health, and are rightly considered to be nothing less than the great dispensaries of nature.

The mineral waters in general appear to differ from the other forms of terrestrial water, in the constant amount of their mineral impregnation, and its unvarying character. Even sea-water is said to differ much in different localities, as to the amount of the solid matter held in solution. The water of the Mediterranean is reported to contain a larger amount of saline matter than that of the British Channel ; and this, than the water of the German Ocean ; and this, than the water of the Baltic. Whether this opinion be eventually ascertained to have been well founded or not, in the instance of the waters of rivers, lakes, and springs, and even in that of rain-water, the greatest differences in their degree of purity are found to obtain, under different circumstances as to temperature, character of vegetation, the quantity of rain that may have fallen recently, &c. Moreover, the amount of mineral impregnation, or of alkaline, calcareous, saline, chalybeate, or gaseous matters, contained in the common terrestrial waters, is sometimes greater than that which is contained in many mineral waters of established character for their medicinal effects ; but the variable amount of the mineral impregnation in the common terrestrial waters, and frequently the very variable character of such impregnation, forms an important distinction between these waters and the generality of the mineral waters strictly so called. In illustration of this, the thermal waters of Buxton were analysed in the year 1784, and again, with the aids of an advanced science, in 1820 ; and in both cases, the same amount of mineral impregnation

was found to characterise them : the same remark applying to the different analyses of the more important of the mineral waters that have been made at different periods, when they have been conducted with sufficient care and skill to be of a trustworthy character. In the case of thermal waters more particularly,—but the observation may be extended to many of the cold mineral waters,—even the quantity of the water poured out from the several springs at different periods of the year, under the different atmospheric circumstances of hot weather and cold, wet weather and drought, may not be found to vary in any degree ; showing, very conclusively, that the waters to which this observation is applicable, are not in any degree dependent on the rains for their supply, but are altogether derived from some other source ;—whether that source be or be not a conduit leading directly from the ocean ; by which the water is conveyed to the *fault*, or rupture in the stratification, through which the mineral water escapes finally to the surface. If this view be admitted to be the most feasible solution of this problem that has ever been advanced, there is no difficulty in understanding how the waters of the ocean might be deprived of all their saline constituents, by having to percolate extensive beds of gravel, or other porous strata, which would have the effect of removing any amount of saline impregnation such water might contain. Any degree of mineral impregnation would be subsequently given to such water by the strata through which it might thereafter have to pass, supposing such

strata to contain soluble materials; and any degree of elevated temperature by which such mineral water might be characterised, might, with sufficient probability, be ascribed to the circumstance of its having passed through strata at a given depth below the surface of the earth. By ascertaining the temperature of the rocks at different depths below the surface, it has been inferred "that the earth becomes warmer by one degree for every forty-four feet of depth, stating it in round numbers; and, consequently, at a depth of not more than a few thousands of feet, the temperature of the earth may be such as would raise water to the boiling heat of 212° : enough has been ascertained to justify the conclusion that this would be the case at a depth of little more than 7000 feet—a depth that bears no greater proportion to the earth's diameter, than a few inches bear to a mile. These views, as to the origin of the tepid mineral waters, and the source of their elevated temperature, are confirmed by the circumstance, that thermal springs are found in the greatest abundance in the neighbourhood of active or recently active volcanoes, and that volcanoes are hardly ever found to exist without giving rise to springs of tepid water. And in those situations where no traces of volcanic agency can be detected in the neighbourhood of tepid springs, these waters are always found to issue from the primary rocks, chiefly from granite, either directly, or from beds of inconsiderable thickness, which evidently form a mere crust over rocks of the primary class." *

* Buxton and its Waters.

From the earliest ages, mineral waters have been resorted to by mankind, as great and trustworthy means of relieving or curing diseases; and, in all ages, and under all the different and varying circumstances of mental darkness and enlightenment, of superstition and its worse opposite, of Paganism, Mohammedanism, and Christianity, of the intertropical and the temperate regions of the earth, of the denizens of hills, plains, and valleys,—mineral waters have been found to hold a high place in public confidence. And it is a curious fact, that no country in the world appears to be destitute of mineral waters; and they have been subjected to investigation and study, as to their properties and effects, by chemists and medical men, in Portugal, Spain, France, Switzerland, Germany, Italy, Greece, Great Britain, various districts of Asia, both continental and insular, the continent and islands of Africa, and the continents and the islands of North and South America.

The respective temperature of the different mineral waters is found to range from the comparative cold of some 60° , to the actual boiling heat of 212° ; and warm and cold mineral waters are respectively found in almost every country.

Besides the important division of mineral waters into those which are warm and those which are cold, they are further divided according to their predominant principle, or most characteristic effect on the animal economy, into the saline, the chalybeate, the sulphureous, the calcarous, and the acidulous. This division is, in most cases, sufficiently justifiable,

and of practical advantage in determining their selection for use in individual cases ; but a more rigorous analytical inquiry into the nature of their chemical constituents, has thus far failed most signally in serving any purpose of practical good ; and, on the other hand, has rather tended to raise some mineral waters to an undeserved degree of short-lived fame, and to lower others to a degree that their curative value has not permitted to be lasting. It by no means follows, that, because chemistry enables us to determine that a given mineral water is of saline character, that the degree of its efficacy on the human body can be likewise predicated from the same premises. The investigations of chemistry are still far too limited in their results, or too uncertain in their minuter details, to justify any such inference, independently of a patient observation of the effects of the different mineral waters on a large aggregate of healthy and disordered conditions. Nor need this be regarded as offering a singular exception to what obtains in other departments. Men are perhaps apt to forget that the science of chemistry is yet in its infancy ; an opinion which every year serves to confirm more and more. A very few years ago it used to be said authoritatively, that sugar is the most nutritious of the articles of food ; that butter and fat are likewise pre-eminently nutritious ; whereas an advancing chemistry has determined that no result of organisation that does not contain nitrogen, can minister to the azotised tissues without the addition of azote, and that such aliments are, therefore, under

all ordinary circumstances, only capable of ministering to the respiratory wants of the living body. It used to be said, that because lignin and starch have apparently nearly the same composition, and seemingly consist of the same elementary substances, therefore saw-dust might be substituted for starch in the manufacture of bread, or be made to minister to the nutrition of the animal economy. Further investigation has shown, that, were this opinion so far true as to be indisputably tenable, the solubility of lignin is so much more difficult than the solubility of starch, that under no common circumstances, or to no adequate degree, could it be held capable of supplying the wants of the animal system. And to at least the same extent, must chemical conclusions, and inferences from them, as to the effects of the different mineral waters, be received guardedly, and held subject to the confirmation of a due observation of their effects on the system; or they may lead to much and most serious error. And this is not surprising, considering the question on its own merits alone. It is inferred justly, from a careful analysis, that a given mineral water contains a certain proportion of gaseous and of solid re-agents; and the elementary nature of such re-agents may be in a great measure determined, with undisputed accuracy. But no chemist can determine how these elementary substances are combined in the mineral water, nor predicate definitely, or beyond a certain point, from his researches, what are the effects of such mineral water on the animal system. He may,

indeed, determine, from his researches into its composition, that the mineral water he has analysed will possibly exert purgative effects on the system; but he cannot determine to what extent the said water will have this effect; and it may prove to be much less or much more purgative than his analysis would have rendered probable. And, even more than this, a mineral water of undeniable power, in its effects on the system, may afford to the laborious and painstaking analyst no clue to the cause of its efficacy. The results of analysis in the case of the different mineral waters, may be fairly said to be of value, only in so far as they enable us to class them into the several heads of saline, sulphureous, chalybeate, &c.; and to be useless, and perhaps only likely to mislead, in any attempt to compare the individual mineral waters of the same class with one another, as to their respective effects on the human body.

The European mineral waters are almost exclusively interesting to the people of Great Britain, from being sufficiently accessible to invalids. The mineral waters of Germany are more resorted to than those of any other foreign country, owing, as it seems, to the rivalry, or, perhaps, it may be the jealousy, of its different sovereignties and principalities,—and, it should be added, to the energy, perseverance, and patient civility of the people; such preference not seeming to be justly referable to any intrinsic superiority possessed by the German mineral waters, either as to physical characters, or medicinal effects, over the mineral waters of the other countries of the world.

The saline mineral waters usually exercise a purgative effect on the animal economy. These mineral waters commonly owe their aperient properties to the sulphates of soda, or magnesia, or potash, and the chlorides of sodium or magnesium. In many cases, they contain a larger or smaller, an important or unimportant, impregnation of iron. In many of the mineral waters of this class, a minute proportion of iodine and of bromine has been detected, which may well be believed to influence their medicinal properties. In this country, the principal mineral waters of this class are found at Cheltenham, Leamington, Harrogate, Ashby-de-la-Zouch, Epsom, and Scarborough; the principal mineral waters of this class on the continent, being those of Seidlitz and Seydehutz, in Bohemia. Püllna likewise possesses a saline water of considerable importance. The water of Marienbad has an important alkaline as well as aperient property. Many of the alkaline and thermal waters, as those of Vichi, Carlsbad, Wiesbaden, and Baden, contain a certain amount of sulphate or muriate of soda, which would lead to an inference that they may exercise aperient effects under some circumstances, and justify their classification under this head.

Sulphureous mineral waters are likewise usually remarkable from their action as aperients. Their properties are prominently due to the large impregnation of sulphuretted hydrogen with which they are severally charged, aided by the presence of saline aperients in greater or less amount, of which chloride of sodium is commonly by far the most important. The sul-

phureous springs of Harrogate are probably the most important in the world, although labouring under the admitted disadvantage of being offered at the natural temperature, instead of belonging at the same time to the class of thermal waters, as do those of Bareges and Aix la Chapelle ; of which the former is said to issue from the earth at the temperature of 113° , and the latter at 144° . The sulphureous waters of Harrogate are said to contain an impregnation of from 3 to 21 cubic inches of sulphuretted hydrogen in the gallon, whereas those of Aix la Chapelle are said to contain 133 cubic inches of this gas in the gallon. On the other hand, the sulphureous waters of Harrogate contain a much larger proportion of saline matter than those of Aix la Chapelle. Moffat, Strathpeffer, and Rothsay, situated in Scotland, are likewise remarkable for possessing springs of sulphureous water ; which are said to be impregnated with sulphuretted hydrogen in much the same degree as the sulphureous springs of Harrogate ; although their saline impregnation is much less considerable.

The carbonated mineral waters are chiefly valuable from their action as antacids. To this group belong the mineral waters of Selters (Seltzer), Pyrmont, Pougues, Mont d' Or, and Vichi ; to which may be added, with more or less propriety, those of Spa, Carlsbad, &c. The Selters waters are stated to contain 343·8 cubic inches of carbonic acid in the gallon ; the several springs of Pyrmont, from 135 to 300 cubic inches ; that of Pougues, 325·9 cubic inches ; those of Mont d' Or, from 4·79 to 23·95 cubic inches ;

and those of Vichi, 132·84 cubic inches of carbonic acid. The waters of Spa contain, respectively, from 201 to 336 cubic inches of carbonic acid in the gallon; and those of Carlsbad contain 124 cubic inches of this gas. The waters of Spa belong, however, to the class of carbonated chalybeate, and those of Carlsbad to that of carbonated saline. In addition to the large proportion of carbonic acid which is obtained from this class of mineral waters, they are all essentially characterised by an important amount of alkaline impregnation, upon which their medicinal action more particularly depends. Thus, in the gallon of these several mineral waters respectively, those of Selters contain 210 grains of the carbonates of soda, lime, and magnesia; those of Pyrmont, from 70 to 100 grains of the carbonates of lime and magnesia; that of Pougues, 220 grains of the carbonates of soda, lime, and magnesia; those of Mont d' Or, from 60 to 67 grains of the same carbonates; and those of Vichi, from 300 to 429 grains of these carbonates. The waters of Spa, although chiefly distinguished as highly carbonated chalybeates, contain from 2 to 15 grains of carbonated alkaline matter in the gallon. The waters of Carlsbad, in addition to the aperient saline effect to be expected from 182 grains of sulphate of soda, and whatever influence may be referred to 124 cubic inches of carbonic acid, afford by analysis 123 grains of the carbonates of soda, lime, and magnesia; and are of unquestionably more medicinal importance from their alkaline action on the system, than on account of their other

effects. There does not appear to be any mineral water in Great Britain, of sufficient pretension to deserve mention under this head. Even that of Ilkeston, in Derbyshire, does not seem to afford more than 3.55 grains of carbonate of soda in the gallon; and the other carbonated waters, chiefly found in Derbyshire and the adjoining parts of Yorkshire, afford little but the earthy carbonates, and may be assumed to have little, if any, medicinal efficacy.

The chalybeate mineral waters owe their medicinal virtue to the presence of oxyde of iron, commonly held in solution by carbonic acid. In England, the waters of Tunbridge are the most important of this class; and more especially, if a pure chalybeate water is required. These waters contain 9.66 cubic inches of carbonic acid in the gallon; the entire solid material obtained being only 9.068 grains,—2.748 grains of this being protoxyde of iron. The waters of Cheltenham, Leamington, and Harrogate, contain a larger or smaller, but by no means unimportant, impregnation of iron; in combination with saline matters, having purgative properties, which may or may not be indicated in different cases. In Scotland, the Moffat chalybeate, and the Vicar's Brig chalybeate, seem to be important; although labouring under the evident disadvantage of an aluminous impregnation. Chalybeate waters, of sufficient strength to possess important medicinal efficacy, are sufficiently common in most coal and iron-stone districts. It is usually advisable, however, to ascertain whether the spring be free from any aluminous

impregnation. A sufficiently strong and pure chalybeate spring for medicinal purposes, arises from the shale, in a very narrow slip between the limestone and gritstone formations, on the edge of the former of which the town of Buxton is situated. In this case, the iron is held in solution by carbonic acid. The importance of the chalybeate mineral waters as medicinal agents, is probably not second to that of any of the varieties of mineral waters. The proved deficiency of iron in the animal system, in certain disordered states of the economy; and the remedial effects that are consequent upon the medicinal use of iron under these circumstances, are well known, and matters of very frequent observation. Even in the most marked and aggravated instances of such morbid states, there is a frequent and even common experience of difficulty and disadvantage in accomplishing the indication, owing to the local or general derangement of the system that is occasioned by the preparation of iron which is exhibited: a disadvantage and difficulty seldom experienced when iron is exhibited, in fitting states of system, in the form of the chalybeate mineral waters; and especially, if the iron contained in such waters is held in solution by carbonic acid, and if the water is essentially free from any aluminous impregnation. The conditions of system in which a pure chalybeate water, or a chalybeate water containing at the same time an impregnation of saline aperients, may be preferred, often require considerable discrimination and care. One of the saline springs of Harrogate is particularly

important, from containing an efficient impregnation of carbonate of iron; and some of the springs of Cheltenham and Leamington contain an efficacious proportion of oxyde of iron; and the great thermal waters of Bath may be inferred to have their medicinal effects modified, and perhaps in some cases determined, by the proportion of oxyde of iron which they contain in combination with the calcareous and small proportion of saline matter, held in solution by carbonic acid.

Of the chalybeate mineral waters on the Continent of Europe, those of Spa are the most important. The several springs contain from 1 to 14 grains of the oxyde or carbonate of iron in the gallon, in combination with calcareous, and some small proportion of saline and alkaline matters; the whole being held in solution by the large amount of from 150 to 336 cubic inches of carbonic acid. The waters of Mont d' Or, Vichy, Carlsbad, Pyrmont, Kissingen, Selters, Marienbad, &c., may be supposed to owe some part of their medicinal influence to the proportion of iron which they severally contain, in combination with their more important alkaline, or saline impregnation.

Premising that there is probably no country in the old or the new world, that does not possess mineral waters of an elevated temperature; such springs ranging in respective temperature from 58° to 212° ; and being generally remarkable from the circumstance of maintaining their degree of heat in all times and seasons, as well as from their being discharged in the same quantity at all periods, without

reference to weather or season ; the following is a list of some of the more important of the thermal waters of England and the continent of Europe, with their respective temperatures :—

	Degrees.		Degrees.
Matlock	68	Töplitz	113
Buxton	82	Aix la Chapelle	144
Bristol	74	Wiesbaden	151
Bath	117	Ems	122
Bareges	113	Schlangenbad	86
Aix	113	Baden-Baden	154
Pfeffers	100	Wildbad	95
Carlsbad, Sprudel	165	Lucca	129
Teplitz	121	Civita Vecchia	86
Pisa	106	Castellamare	104
Gastein	122		

The medicinal value of the thermal mineral waters, is unquestionably influenced by the temperature at which they are offered; and it may be, perhaps, generally admitted, that waters, having the same apparent character and degree of mineral impregnation, will have more efficacy, if enjoying the additional character of belonging to the class of thermal waters.

The mineral waters of Matlock (temperature 68°) contain a very small amount of mineral impregnation; this being chiefly calcareous, in combination with carbonic acid, &c.

The thermal waters of Buxton (temperature 82°) are likewise principally calcareous, and in a minute degree saline; they contain likewise some free carbonic acid; but their great chemical characteristic is, that nearly three-fourths of the gaseous contents

are found to be uncombined nitrogen. It is fair to infer that the remarkable effects of these waters, may be referable, in an important degree, to the gaseous impregnation.

The waters of Bath are offered at the elevated temperature of 109° , 114° , and 117° , respectively. They are characterised by a larger calcareous and saline impregnation than those of Buxton; and by containing, moreover, a small but efficient proportion of iron.

The tepid water of Bristol (temperature 74°) is chiefly remarkable for its weakly calcareous and saline character.

The thermal springs of the Continent may be usually referred to the class assigned by their predominating ingredients, the greater medicinal efficacy ascribed to their elevated temperature being kept in view; and the saline, alkaline, sulphureous, and chalybeate characters may be considered to be enhanced, but not otherwise modified, by the elevated temperature. Thus, the mineral waters of Bareges are principally sulphureous, although in some degree calcareous and saline likewise; these medicinal properties being enhanced by the elevated temperatures of the several springs, which are 88° , 100° , and 113° , respectively. The mineral waters of Aix are calcareous and very slightly saline, but are chiefly important from their sulphureous impregnation; the medicinal effect being increased by their elevated temperature, which, although diminished during the rains of the equinox, and during the melting of the snow, is usually 113° . The mineral waters of

Aix la Chapelle, enhanced as their medicinal action may be by the temperature of 144° as they issue from the earth, and retaining the heat of 119° to 120° when collected in the reservoirs, are chiefly valuable from their large impregnation of sulphuretted hydrogen, combined with an important amount of saline, alkaline, and calcareous ingredients. The mineral waters of Carlsbad, important as their elevated temperature should be admitted to be, in adding to the effect of their mineral and gaseous impregnation, must be classed as chiefly valuable from their alkaline characters. The springs of Carlsbad vary in their respective temperature, from 122° to 165° . As is the case in the thermal waters of Buxton, and probably in those of Bath, and many others, Berzelius found free nitrogen in the Carlsbad waters, although in comparatively small proportion. The composition of the Carlsbad waters offers one of the great practical suggestions which has served so much to advance the modern art of prescribing. This great alkaline agent does not owe its wonderful efficacy in certain morbid states to the presence of carbonate of soda or magnesia, or the different salts of lime, but to a combination of these alkaline re-agents; and on the same principle, in the modern practice of medicine, where alkaline effects are required for the relief of morbid action, it is found that more beneficial results may be obtained by a prescription containing the different alkaline re-agents, than by ordering any of the pure or the carbonated alkalies, or alkaline earths, by themselves. It was a

much older discovery, but evidently founded on the same principle, that purgative medicines usually prove more efficient, and less drastic in their action, when compounded of several different purgative ingredients; and the same principle is found to be capable of most useful extension to the classes of diaphoretic and diuretic medicines, &c.

The saline, calcareous, and slightly chalybeate properties of the mineral waters of Wiesbaden, are much enhanced in medicinal effect by the elevated temperatures at which they are severally offered; varying from 117° to 151° ; and the same remark applies to the similar waters of Baden, in Switzerland, (temperature probably little short of 212°),—and to those of Baden-Baden, (temperature 154°).

Their severally elevated temperatures add to the alkaline effects of the mineral waters of Vichi, 113° , Ems, 122° , and Töplitz, 121° ; and to the calcareous effects of the mineral waters of Schlangenbad, 86° , Lucca, 129° , &c.

The mineral waters and watering-places of England deserve to be mentioned somewhat more particularly in this work. They may be divided into those which are thermal and those which are cold; the latter being subdivided into saline, chalybeate, and sulphureous.

The principal of the thermal waters of England are divisible into two groups; of which the one arises from fissures in the secondary limestone, or mountain limestone formation, constituting what is called the Peak of Derbyshire; and the other from the oolite formation, which occurs on the borders of

the counties of Gloucester and Somerset. The first of these groups includes Buxton, Bakewell, Stony-Middleton, and Matlock; the second includes Bath, and Clifton or Bristol.

The Peak of Derbyshire, which embraces the first of these groups, consists principally of a mountain limestone formation. This formation is about fourteen miles broad from the south-west to the north-east, and about twenty miles long. It is the southern extremity of a ridge or chain of hills, that extends from Scotland to this part of Derbyshire. The whole of the Peak is considerably elevated above the level of the sea; the highest mountain tops being of an elevation of between two and three thousand feet; Buxton being at an elevation of one thousand feet, and Bakewell, Stony-Middleton, and Matlock, being considerably lower. Through fissures in this formation, the thermal waters of this district make their way to the surface.

Although Buxton is situated at so considerable an elevation, it is well sheltered on all sides by hills and plantations; and the dryness of the atmosphere is secured not only by the elevation, but by the remarkably absorbent character of the mountain limestone. The purity of the air, and the degree to which it is free from miasmatic matters, are proved by the circumstance that endemic or epidemic fever is unknown in the town or its vicinity.

Buxton is indebted for its principal buildings, plantations, walks, and other embellishments, to the taste and liberality of successive Dukes of Devonshire,

to whose noble family Buxton has chiefly belonged for many centuries.

The thermal waters are used both internally and as baths. Their temperature is invariably 82° ; and the supply of water is unaffected by weather or season. They are found to be chiefly useful in cases of rheumatism and gout, and in some dyspeptic and atonic conditions. The word rheumatism is considered to include the various forms of neuralgia, as *tic doloureux*, *sciatica*, &c. The baths are spacious, and provided with the proper means of douching any part of the body. There are likewise warm-baths, in which the mineral waters are heated to any higher degree of temperature that may be required.

Matlock is much less important as to the efficacy of its mineral waters. These waters are only at the temperature of 68° ; and they contain little of the gaseous impregnation, especially nitrogen, for which the waters of Buxton are so remarkable. Matlock offers all the great advantages of the limestone atmosphere, together with a singularly well sheltered and highly picturesque locality. Indeed the whole of the Peak of Derbyshire, and more particularly its valleys, of which Matlock is one of the most important, is remarkable for its scenic beauties and rocky grandeur. Matlock offers the invalid a mild, well-sheltered valley-residence, with an absorbent soil.

Bakewell is even less noted than the preceding on account of the mineral waters. It is more celebrated for the excellence of the adjacent trout-streams, and for the beauty of the adjoining district.

Stony-Middleton is situated picturesquely in one of the Derbyshire valleys; but neither the town nor its waters offer any temptation to sojourners.

The southern division of the thermal waters of England is likewise of much importance.

The waters of Bath are offered at the temperature of 117° ; rendering some degree of cooling necessary before they can be made use of. They are used as baths, and taken internally. They are valuable in many cases of atonic dyspepsia, and in debilitated conditions generally, whether consequent upon gout or rheumatism, or otherwise. They are of use in many of the ailments incident to advanced life. They have long been remarkable for their effects on the partial paralysis consequent on the introduction of lead and some other mineral poisons into the system; and this justifies the inference of their usefulness in other conditions of the nervous and motor systems, of similar character. The baths, pump-room, and other appurtenances of a watering-place, are offered at Bath in the best manner; and the size of this important city, the beauty and excellence of its crescents and squares, the rich and highly cultivated character of the surrounding country, together with the dependent circumstance of its unequalled markets, are additional recommendations of no secondary importance.

Bristol, or rather Clifton, the tepid waters emerging below the latter town, affords a valuable climate to the invalid; and is even more important on this account than for the sake of its waters. The temperature

of the mineral waters is 74° . The waters are slightly saline, and chiefly calcareous; with a gaseous impregnation, consisting principally of carbonic acid. They are conceived, and probably with justice, to aid the effect of the climate, in diminishing the morbid sensitiveness of the pulmonary mucous membranes, promoting the action of the kidneys, and giving tone to the digestive organs, in enfeebled conditions of system.

From the great oolite formation, extending across England, from the coast of Yorkshire to that of the county of Dorset,—which is divided from the mountain limestone which allows the tepid waters of Derbyshire to pass through its fissures, by the millstone grit, the coal formation, the magnesian limestone, and the red marl,—arise the thermal waters of Bath and Bristol; and the saline waters of Cheltenham probably arise from the lias, or lower beds of the oolite series. The saline waters of Leamington may possibly arise from the same bed of lias as that from which the saline waters of Cheltenham spring; or both the Cheltenham and the Leamington mineral waters may emerge from the immediately subjacent bed of red marl,—a formation which covers the extensive flat called the Plain of Warwick. This is not, however, a point of much interest, even in a geological view. The red marl, or new red sandstone formation, lies immediately beneath the lias, or lowest stratum of the oolite series; and from the one or the other of these formations, it seems probable that most of the saline mineral waters of England take their rise.

Cheltenham is situated in a beautiful and extensive valley, about two miles from the base of the hills which bound the valley on the north-east. The soil is dry; absorbent enough to carry off excessive moisture. The valley is sufficiently extensive to prevent any undue stagnation of the air; and the hills protect it from the more chilling influences of the north and north-east winds. The houses are scattered in detached groups, by which the most free street ventilation is secured. This conduces much to the healthiness of Cheltenham, inasmuch as, in the words of Dr. M'Cabe, "No narrow or winding lanes intercept the free current of the air, and no neglected and unfrequented places serve as reservoirs for the collection and evolution of noxious effluvia, which, with other concurring causes, might generate the seeds of disease. Where every place is open and exposed to public view, cleanliness cannot be neglected; and where perfect cleanliness is attended to, and exposure to a free and pure atmosphere is the necessary consequence of situation, diseases will seldom be met with."*

Cheltenham offers every accommodation to its visitors, that good walks, sheltered promenades, good roads, commodious pump-rooms, good houses, and a pleasant climate, are understood to comprise.

The Cheltenham mineral waters are essentially saline in the character of their impregnation; containing principally, sulphate of soda, and chloride of sodium, and the chlorides of lime and magnesium.

* Observations on the Cheltenham Waters. By James M'Cabe, M.D.

These waters are useful in a large number of the cases of abdominal and hepatic congestion. The stimulating character of all mineral waters may make some preparatory attention, and some degree of watchful care during the course, necessary, even in the most strongly marked of the cases to which these waters prove to be so largely beneficial.

Leamington is situated at the distance of two miles from Warwick. The attractive and varied and beautiful country by which it is surrounded, its mild inland climate, the excellence of its houses, streets, and roads, are among the strong advantages offered by Leamington to its visitors.

The waters of Leamington resemble in all essential particulars the waters of Cheltenham; and may be generally said to be applicable to the relief of the same morbid conditions.

“Leamington,” says Dr. Loudon, “from being situated at a distance from the coast, and in the midst of a level country, is neither exposed to sudden gusts of wind, nor to the frequent rains which a mountainous neighbourhood so constantly attracts. Besides, being nearly at an equal distance from the east and west seas, as well as the channel, the temperature is more mild and equal than that of the greater part of the inland watering-places in the country, and the climate more genial than that of towns in the same latitude, lying nearer to the Atlantic and German Oceans. The highly cultivated state of the soil around the town, entirely free from morasses, with the numerous scattered woods and rivulets, contributes,

in no small degree, to its being one of the most salubrious spots in the inland counties.”*

Tunbridge Wells, the most celebrated of the chalybeate mineral waters of England, is situated in a somewhat barren part of the county of Kent. The mineral waters emerge from the lowest of the three beds of green sandstone, which lie immediately under the great chalk formation. The waters are clear, with a chalybeate odour, and strongly marked chalybeate taste; but the taste is not marked by either an acidulous or saline character, and is not considered to be unpalatable. The waters are at a little varying temperature of 50°. Their chalybeate impregnation is 2·748 grains of oxyde of iron in the gallon, held in solution by carbonic acid. Their action is essentially tonic and deobstruent; and they have been, no doubt, less used than they deserve to have been, in the various diseases dependent on debilitated conditions.

Tunbridge offers to its visitors the advantages of a pure air, an inviting and somewhat picturesque country, and the usual walks, rides, and other accommodations that are looked for in watering-places.

Harrogate is situated very near the middle of the great county of York. The formation is a bed of shale, which lies between the magnesian and the mountain limestone; and may be said to represent the great coal formation, which in other parts occupies the same geological position. The several

* On the Waters of Leamington Spa. By Charles Loudon, M.D.

impregnations of the different mineral springs of this important watering-place, may be due to the shale formation, through which they issue to the surface ; or may be partly ascribed to a solution of the saline and sulphureous materials of a boggy soil which rests on the shale. It does not seem improbable, that the waters may acquire from the bog-land, in which vegetable matters appear to be in a state of extreme decomposition, a considerable amount of sulphureous and saline impregnation, which may be modified by the subsequent percolation of the waters through the shale. Dr. Neale, who practised at Harrogate about the end of the seventeenth century, appears to have been one of the first to collect the sulphureous and saline waters of this place ; and, indeed, he says that he “made a large bason to contain several hogsheads of water, and covered it with a large stone, to preserve it from the sun and rain water ; and for a week together we rammed its sides with clay, to prevent other springs from getting in ;” and he adds, that “the earth about these spas is black and bituminous, the surface whereof in hot weather is candied over with a yellow scurf, which is perfect brimstone.” Dr. Short says, writing in 1734, “The soil out of which these springs rise, is, first, corn mould, then a marl stone.”

The sulphureous waters of Harrogate are transparent, having a strongly sulphureous and fetid smell, and a saline and most disagreeable taste. The temperature probably varies, but is stated to be 54°. The importance of these waters, either used internally, of

made use of as baths, for which every accommodation and convenience are afforded, can hardly be over-estimated in many of the cases of hepatic derangement, and of the more chronic cutaneous diseases.

Harrogate likewise possesses pure chalybeate, saline-chalybeate, and pure saline mineral waters, which are respectively valuable to many invalids, either preparatory to commencing the course of the sulphureous waters, or auxiliary to the effects of those waters, or made use of after such course has been completed. These several waters are necessarily found useful in many cases, to which the sulphureous waters are not at all applicable.

Harrogate affords to its visitors all the usual watering-place accommodations and conveniences; and every means are had recourse to, for securing the comfort of those who resort to it for the sake of its justly celebrated mineral waters. Its air is bracing.

All mineral waters, including even those that are purely saline, are more or less stimulating; and this is perhaps particularly the case, when the water is warmer than the natural temperature. It is therefore obvious, that the use of these great agents should not be permitted in cases that are attended with febrile excitement, nor in systems characterised by plethora, until, in the one case, the febrile action has been subdued, and in the other case the full habit of body has been reduced, by dietetic regulations and medicinal means.

“We agree with Alibert,” writes Dr. Gairdner, “in regarding all thermal waters, and most mineral springs generally, to be physiologically and therapeutically *stimulant*; and that the degree of excitation is proportionate to their temperature. This may be stated to be the fundamental principle of thermological medicine; and is therefore of the utmost importance to be kept in view in determining the particular class of diseases, or the particular stage of any given disease, which they are likely to benefit. This stimulant power may be directed to very different organs. They may sometimes act by exciting the capillary circulation, the secretion of urine, the alvine excretions, the digestive functions, the locomotive organs, or, finally, the nervous system generally. In the early or acute period of a disease, they will seldom be beneficial, in most cases highly injurious, especially in that great class comprehended under the general title of *Pyrexia*. But, when it has assumed the chronic or indolent character, signal benefit will frequently result from their judicious application.”*

The observation of the remarkable effects of the mineral waters on the various powers of disordered action that are of more chronic character, teaches and impresses the value of a comparatively expectant treatment of such cases, when the use of mineral waters may not be of sufficiently ready access. It need not be hoped, that, by any artificial means, the same large amount of curative results may be obtained, as would follow the judicious and well-timed use of

* On Mineral and Thermal Springs. By Meredith Gairdner, M.D.

the appropriate mineral water in such morbid conditions; but a considerable amount of benefit may be generally obtained by imitating the *methodus medendi* adopted by nature. The large secondary means of cure, which generally obtain when the invalid makes use of a mineral water, may or may not be enjoyed in connection with the artificial treatment; and no observing person could undervalue the effects on the body and the mind, of change of air and scene and society, of being removed from the ordinary pursuits of life, of being freed necessarily from some of the daily cares and anxieties of the ordinary avocations, of being taken out of the wearing and wearying routine of duties and engagements. These are, indeed, important elements in the advantages offered to all classes of invalids by watering-places in general; and often, beyond a doubt, contribute largely to the curative results obtained by resorting to them. In a large number of chronic cases, salines, chalybeates, alkalies, &c., may be given with a much greater chance of beneficial results, if prescribed in some degree after the model presented in the several mineral waters. The strongest of the saline waters of Cheltenham and Leamington only afford, upon analysis, from 1000 to 1200 grains of salts in the gallon of water; the strongest sulphur water of Harrogate only shows 1016 grains in the gallon; the great alkaline saline water of Carlsbad only yields 383 grains from the gallon; and supposing an eighth, or a fourth part of a gallon of these waters, or somewhat more or somewhat less, to be taken daily, by so much

smaller must be the dose of really medicinal mineral matter, that is day by day made to bear upon the morbid state, and found to fulfil curative indications. And yet it appears, from the universal experience of the profession, that, in the case of every one of the great mineral waters, when the mineral water is adapted to the nature of the complaint under treatment, the difficulty which is felt is that the water is apt to prove too active, or too stimulating, in its effects, and that these have to be modified by exhibiting the remedy in smaller doses, or by correcting such effects by medicinal means. When it is remembered that the unquestionably efficacious chalybeate waters of Tunbridge Wells contain less than three grains of oxyde of iron in the gallon, and that even the strongest of the springs at Spa contains little more than six grains of oxyde of iron in the gallon, the fact of their efficacy, and of the careful way in which it is found necessary to exhibit them, become still more remarkable. Supported by these facts and the unavoidable deductions, it could hardly be doubted *à priori*, that much might be done in the treatment of many chronic morbid states, by a persevering use of appropriate remedies in small doses, largely diluted. When I say small doses, I do not mean what are called infinitesimal doses, or any similar appeal to the irrational and absurd; but simply, doses much smaller than are usually exhibited, and from which it may be unlikely that any immediate effect should be produced, either on the bodily functions, or on the disease. The degree of dilution in which such

medicinal substances are offered, has, no doubt, likewise much to do with the smallness of the dose from which efficient results may be obtained.

These views, which were earnestly advanced in the first edition of this work, have been confirmed most fully by an ampler experience. In the cases of such invalids as are suffering under chronic ailments, either as to stage or as to character, in whom a course of saline, or chalybeate, or saline chalybeate, or alkaline medicinal action is indicated, and who are prevented by pecuniary or other considerations from having recourse to the suitable mineral waters, with all their admitted superiority, and all their secondary advantages of change of air and scene and social influences, the best results that can be gained by medicinal treatment may be usually obtained from minute doses of the corresponding drugs, given in a state of ample dilution. From a few grains to a drachm of the aperient salts may be given in a pint or more of tepid water, every morning before breakfast, in divided doses, using exercise between the doses ;—the salts being either sulphate of magnesia, or sulphate of soda, or a combination of equal parts of these salts, or a mixture of sulphate of soda and chloride of sodium in any desired proportions, or a mixture of sulphate of soda and carbonate of soda, or of other alkaline and aperient salts. In the cases of other invalids, in whom a chalybeate action seems to be required, a very few grains of carbonate of soda may be dissolved in whatever quantity of warm water can be swallowed

in the course of some hours, at stated intervals; and one drop, or less, or more, of the tincture of the sesquichloride of iron be added to this. In the cases in which the use of a saline chalybeate seems to be indicated, the combination of sulphate of soda, chloride of sodium, and carbonate of soda, with the same preparation of iron, is sufficiently convenient for all purposes. In the cases in which a course of largely diluted alkali seems to be required, the mixed carbonates of potash and soda are readily diluted to any extent. Any such artificial mineral waters should commonly be taken at a tepid heat, from 75° to 90° .

This is an outline of a mode of treatment that deserves to be considered on its own merits, and to be fairly and fully carried out. I can speak to the general results with undoubting confidence. It must be always regarded, however, as in all respects inferior in curative pretensions, to the veritable concoctions of Nature herself.

Before concluding these observations on mineral waters, it should be said, that any artificial addition to a mineral water, whether of aromatics, or of an extra proportion of iron, or of alkali, or of salines, or of more powerful medicaments, is hardly ever advisable. The effects of the mineral water made use of are apt to be interfered with to an important degree by any such additions. The observation refers to the practice, when had recourse to openly and honestly. When resorted to secretly and fraudulently, with the view to increase the immediate effect of a mineral water, and so add to its reputation, the

practice cannot be reprobated too strongly. It is well known, that, in more than one instance, mineral waters of undoubted efficacy have been lowered in public estimation by such unprincipled proceedings. Such cases offer no exception to the golden rule—that honesty is the best policy.

CHAPTER VIII.

On Sleep.—Theory, Definition, and Varieties, of Sleep.—Cases and Causes of Sleeplessness.—Perfect Sleep.—Imperfect Sleep : Dreaming, &c.—Effect of Mental and Bodily Exercise respectively, of Habit, of Constitutional Power, of Health, of the Dietary, &c., on the Amount of Sleep required.—Influence upon the Sleep of Impressions on the Different External Senses, and of Disturbed Sensation of the several more important Organs of Secretion and Excretion, and of Digestion, Respiration, &c.—Some Remedies for Wakefulness.—*Leves Somni Immerentibus haud facile Concessi.*

SLEEP may be fairly and emphatically said to be the great means of compensating for an undue waste of tissue, and of maintaining or restoring the balance of the vital forces. In the words of Professor Liebig, "Since, in different individuals, according to the amount of force consumed in producing voluntary mechanical effects, unequal quantities of living tissue are wasted, there must occur, in every individual, unless the phenomena of motion are to cease entirely, a condition in which all voluntary motions are completely checked, in which, therefore, these occasion no waste. This condition is called *sleep*." Every action of the living body involves expenditure or waste of the exercised tissue ; whether it be the nervous system, in furthering the operations of the intellect, or in conveying the mental behests to the

organs of voluntary motion, or in communicating nervous power to the great processes of circulation, respiration, and other great moving apparatus, that are beyond the influence of the will, but needful to the continuance of life; or whether it be the waste incurred in the use of the apparatus of voluntary or of involuntary motion; or whether it be the expenditure involved in the production of the several secretions which have ulterior and important duties to fulfil in the economy of the system, or that occasioned in the elimination of the excretions, which are no longer needful to the purposes of the organism, and can be no longer retained without injury to its well-being. As far as the intellectual and the higher animal life, distinguished from the organic or vegetative life, such expenditure must in every one's existence be very unequal; the balance between the several faculties and functions must require to be restored at given intervals of time; and this is effected by an entire rest of those variably exercised tissues of the living animal; and such entire rest constitutes sleep.

During sleep, the several senses are relieved from their duties; the organs of voluntary motion are relaxed; the mind and the body are alike free from their vigilance and their labours; there is neither consciousness nor sensation; and the only signs of life are the continued performance of the organic functions.

At stated intervals of time, then, the powers of the system become severally exhausted; the mind and

the muscles of voluntary motion become unable to continue the uninterrupted exercise of their functions; the limbs become relaxed, the spine becomes bent, and the head falls forward; and the mind meanwhile ceases from its labours, the faculties of judgment and memory are gradually suspended, and, finally, imagination, the last to quit and the first to return to its post, leaves it; and the external senses, first sight, then taste, then smell, then hearing, then touch, severally, and one by one, cease their exercise; and—this is sleep.

“The shades descend, and midnight o’er the world
 Expands her sable wings; great Nature droops
 Through all her works: how happy he whose toil
 Has o’er his languid pow’rless limbs diffus’d
 A pleasing lassitude; he not in vain
 Invokes the gentle deity of dreams:
 His pow’rs the most voluptuously dissolve
 In soft repose; on him the balmy dews
 Of sleep with double nutriment descend.”

ARMSTRONG.

The necessity that exists for the temporary repose of such of the vital forces as are more or less under the control of the will, and liable to be unequally exercised, supplies a sufficient rationale of the uses of sleep. It illustrates the circumstance, that the young, in whom such vital forces are necessarily feeble, and in whom there is, moreover, a constant derivation and expenditure of such forces required for the completion of the growth, and for the development of the tissues, require more sleep than adults. It explains the fact, that, as old age advances,

the expenditure of the vital forces becoming less and less, and the equilibrium of such forces being less disturbed, a smaller and smaller amount of sleep is needful to meet the requirements of the system. It exemplifies, and is in its turn illustrated by, the very different requirements of different individuals, in regard to the length of time needed for sleep; this being dependent on the degree to which the vital forces are made use of during the hours of wakefulness, on the degree to which these forces are made use of unequally, on the original strength and power of the tissues by which these forces are manifested, and on their condition as to power at different times. Thus, the man whose mind is occupied exhaustingly in the duties of his profession, will require more sleep in proportion to the amount of such expenditure; and the labourer, after his day of toil, will require more sleep in proportion to the severity of his exertions. Thus, the man who uses equally both the vital forces connected with his intellectual manifestations, and those concerned in the movements of his limbs, will require less sleep, than the man who exercises either of these varieties of vital force duly or unduly, while the equable expenditure of the vital forces in other ways is not secured. Again, those individuals in whom the vital tissues have been originally strong, can support a larger expenditure of vital forces without the need of sleep, than those whose tissues are of feebler organisation; and in such persons, the equilibrium and waste of the vital forces are more quickly restored; and the sleep may be

taken without discomfort at longer intervals, and less sleep is found to be necessary. And again, according to the existing condition of the system as to strength or debility, is less or more sleep found to be necessary. Those who have become enfeebled, by the effects of disease or otherwise, require more sleep than is needful to them at other times. This opinion is not interfered with by the circumstance, that in existing morbid conditions, of febrile, inflammatory, or irritative character, the invalid often passes night after night, during days or even weeks, with little or no sleep. On the contrary, in these conditions, the vital forces are all in a state of unquestionable excitement, and so far in a state to undergo much and long-continued exertions; morbid although such state is in its character, and exhausting as must be the consequence of such exertions; often, beyond a doubt, exhausting to a degree inconsistent with the restoration of health, or even with the continuance of life. The effects of such morbid stimulus on the vital forces, and on their temporary capability of endurance and exertion, are evidenced in other ways, than in the time during which these forces can continue to act, without the repose or the equipoising effect of sleep. In cases of continued fever, many days,—and in one case, that fell under my own observation, no less than three weeks,—have elapsed, during which the patients have literally been unable to swallow the smallest quantity of nutriment; and yet not only has life continued, but all the wearing and exhausting influence of disease has had to be

contended with by the vital forces. In the case referred to, a perfect coma, from which the patient could not be aroused, while it precluded the possibility of mistake as to the fact of the entire abstinence from nutriment, at the same time determined that there should be as small an expenditure of tissue, as could consist with the continuance of life; and not only did the patient recover his consciousness, but he was eventually restored to health. The stimulus offered by diseased action to the vital forces is not, then, solely observable as to its effect of enabling the system to continue without sleep for considerable periods of time. As to this particular, however, the same thing is often observable, to a considerable degree, in cases of lunacy, and other morbid conditions affecting the sensorium. In an inferior degree, the same thing is noticed in cases of high mental excitement, whether from joy or grief, or from anxiety of mind; in which cases the great solace of sleep is often vainly sought for, night after night; and the system is supported by the mental irritant, under such deprivation of its wonted means of restoration and equipoise, until the powers succumb to the eventual exhaustion of the vital forces; or until the irritating influence becomes transferred to some one of the great organs, by the establishment of disease therein; or until, relief being afforded to the mind itself, the tension becomes relieved, and although left much exhausted, the system, by time and rest, gradually regains its tone and equilibrium.

Such is sleep, and such are its uses. Perfect sleep

involves entire loss of consciousness, entire repose of the sensorium, entire rest of the mental faculties ; circulation, respiration, nutrition, and secretion alone involving movement and waste ; the several other functions of the nervous system being in absolute repose, regaining their equilibrium, and recovering their intensity of power.

But there are various degrees of less perfect sleep, in which one or more of the external senses may still be the means of producing impressions on the sensorium ; in which the command over the muscles of voluntary motion may not be wholly suspended ; in which even memory and imagination, uncontrolled by the judgment, and imperfectly tested by sensation or by the senses, may career wildly over the past, or create a present or a future out of its disarranged and diversified materials, overleap the possibilities of time and space, recall the dead to the stage of its creations, cause years gone by to run their round again, filling and embellishing its unreal creations with a jumblement of the probable, the unlikely, and the impossible, and peopling them with whatever memory can recall, or fancy can create.

Such are dreams,—the shades and phases, different gradations, of imperfect consciousness,—degrees of imperfect sleep. Their most curious feature is the degree to which, untrammelled by sensation, and unfettered by the judgment, the action of the mind, and especially as regards its imaginative powers, becomes vigorous and untiring. The rapid changes and quick succession of ideas, that may occur

during an imperfect and dreamy sleep, is well illustrated by Lord Brougham, in "A Discourse of Natural Theology." "Let any one who is extremely overpowered with drowsiness—as after sitting up all night, and sleeping none the next day—lie down, and begin to dictate: he will find himself falling asleep after uttering a few words, and he will be awakened by the person who writes repeating the last word, to show he has written the whole; not above five or six seconds may elapse, and the sleeper will find it at first quite impossible to believe that he has not been asleep for hours, and will chide the amanuensis for having fallen asleep over his work—so great apparently will be the length of the dream which he has dreamt, extending through half a lifetime. This experiment is easily tried: again and again the sleeper will find his endless dream renewed; and he will always be able to tell in how short a time he must have performed it. For suppose eight or ten seconds required to write the four or five words dictated, sleep could hardly begin in less than four or five seconds after the effort of pronouncing the sentence; so that, at the utmost, not more than four or five seconds can have been spent in sleep. But, indeed, the greater probability is, that not above a single second can have been so passed, for a writer will easily finish two words in a second; and suppose he was to write four, and half the time is consumed in falling asleep, one second only is the duration of the dream, which yet seems to last for years, so numerous are the images that compose it."

Lord Brougham carries his opinions on this subject so far, as to say, "There seems every reason to conclude, from these facts, that we only dream during the instant of transition into and out of sleep. That instant is quite enough to account for the whole of what appears a night's dream." Few persons would adopt so extreme an opinion on this subject, who had watched the sleep of people frequently, whether the sleepers were adults or children, invalids or persons in health. Whatever renders the sleep sufficiently imperfect to restore the imagination and memory to a certain degree of force, would give rise to dreaming; and as such disturbing influences are more likely to operate, when some of the organs are suffering from functional derangement, so dreams are more likely to happen to the invalid than to the man in health; as they are more likely to act when the equilibrium and intensity of the vital forces have been well nigh restored by a sufficient duration of sleep, so dreams are more likely to occur in the morning than in the earlier parts of the night. The disturbing influence may be a strong impression on some one of the organs of external sense; and it is curious in this case to find the readiness with which this is mixed up with, and adapted to, the dream that has occurred: thus, a cold night, chilling the extremities of the sleeper, or a storm of wind and rain shaking and beating against the bed-room windows, or an oppressive and feverish state occasioned by an over-heated bed-room, or the loud barking of a dog, or even the lying in an uneasy or unusual position, may render

the sleep imperfect, and both occasion the dream and influence its character. A pile of clothes, or the arrangement of a window-curtain, may impersonate to the dreamer's eye some absent friend, or assume the perfect semblance of some one long deceased, or be supposed to represent an unearthly visitant, or a burglarious assassin. Sometimes, the voluntary muscles are in part or wholly restored to the command of the will; and the curious phenomena of sleep-walking are the result; with all the marvellous possibilities of a sleeper being able to write his next Sunday's sermon, or next month's magazine article; to work out some complicated problem that had perhaps been puzzled over vainly when he was awake; to perform on the familiar instrument of music, long forgotten airs, or brilliant and difficult themes; to find his way during the darkest nights, through intricacies, which, however necessarily well known, would have confused and puzzled his waking senses, if unaided by light.

Such are some of the well authenticated accounts of the doings and capabilities of sleep-walkers; and they have been adduced among the arguments in favour of a belief in the statements of Mesmer and his followers: that people under certain circumstances of nervous excitement, may read with their eyes blind-folded, &c., &c.; the difference between the most surprising of the authenticated phenomena of sleep-walking and the accounts of the mesmerist, being, that the former are always consistent with the capabilities of an excited nervous system, whereas

the latter confessedly exceed them. Thus, it is not inconsistent with our reasonable belief, to find that a sleeper, with his eyes shut, can rise from his bed, perform his customary ablutions, dress himself in his clothes, leave his bed-room, make his way through the accustomed and familiar passages of his house to his sitting-room, place himself in his wonted chair, and draw to him the habitually used writing materials, and, with his eyes still shut, take his pen in hand, dip it into the ink-bottle at almost stated intervals of time, and with one hand on the sheet of paper, the other at its wonted pen-guidance, write out the digested and arranged thoughts of the mind; even although the eyes may be shut all the time, and although such successive feats, without the aid of vision, would be impossible to the person when awake, interfered with by the conscious difficulties, and not under the stimulus of the nervous excitement. This is a very different call upon our belief, from the statement that the interior of the human body, or the thoughts and feelings of a second person's mind, or occurrences that are happening in an adjoining house, or even at a distance of miles or leagues, may be cognizant by the faculties of any one suffering from any degree of nervous excitement, whether produced artificially or otherwise. Cases of cerebral disease often equal or exceed any of the accredited cases of sleep-walking, in the surprising character of their phenomena,—recalling to the mind, events, facts, and the doings of individuals, which had long been forgotten; bringing back the tasks of the

childhood, restoring a long disused familiarity with the Greek or Roman classics, or enabling the patient to sing tunes that may have been once familiar, or may have been once heard, and the occasion forgotten; or, on the other hand, taking away altogether some familiar intellectual acquirements, depriving the scholar of his languages, or the savant of his calculations. This is a very different tax upon the credulity, from the statement that any state of nervous system, however produced, could convey to an ignorant person an instantaneous and intimate acquaintance with the theory and practice of medicine; enabling the subject of the mesmeric ecstasy to diagnose and prescribe suitably for different diseases. So much for mesmerism !

Exercise of the mind and exercise of the body, by so much as they involve a greater expenditure, or larger disturbance of the equilibrium, of the vital forces, by so much require in an equal degree the influence of sleep. It would be a mistake to suppose, that if a man should sit on his chair all the day, or move only from room to room, his mind being engaged actively during the time, he would not require the same amount of sleep that would be needed if the vital forces had been expended to the same degree by muscular exertions, whether in walking all the day in the open air, or in working at some laborious occupation. Not but that, if such mental labours were undergone, and no bodily exercise taken, no change of air enjoyed, an irritable condition of the nervous system would come on, and sleep be either

banished, or rendered imperfect. But if, occasionally, under circumstances of such inactivity of the voluntary muscles, the mind undergoes long and severe exercise, the system is found to require as much sleep, if not more sleep, than if the muscular system, and not the mind, had been at work. And if such an amount of sleep is not enjoyed, it were well to pause, and endeavour to ensure it, by sacrificing some of the next day's moments to the various means by which sleep may be promoted; or, ere long, the mind will become less and less capable of profitable effort: the tired steed will answer to the whip and spur no longer.

Habit influences in some degree the amount of sleep that is required. It should be said, however, that it is never well to withhold any of the revenue that is justly due to the drowsy god. A man may accustom himself to take so little sleep, as to be greatly the loser thereby in his waking moments. It may be commonly observed, that those persons who spend less time in sleep, than is usually found needful by others of the same age and strength and occupation, consume a much larger portion of their days than others do, in a kind of dreamy vacaney, a virtual inactivity of mind and body. The hours expended in sleep are not the only hours that might be justifiably deducted from the sum total of the life, as having been lost to it: numbers of moments are daily spent in an absolute inaction of mind and body; and sleep cannot be robbed of its ducs, without adding largely, and in greater proportion than the

time habitually stolen from the sleep, to that which is wasted in such waking reveries. In order that the mind may have the power of undergoing trying and exhausting labour, that it may continue in the full possession of its capabilities, that it may continue to be undulled and unblunted by such wear and such use, an amount of sleep must be allowed, which is proportionate to the severity of such work, to the engrossing and expending nature of the mind's employment. The nights may be robbed of the hours of sleep; and the time so stolen may be devoted to toil of mind or of body; but the endurance by the system of the undue waste and imperfectly restored balance of the vital force, even if somewhat protracted by the strength of the constitution, or if prolonged somewhat by the energy of a determined will, or by the spur of a great necessity, or by the desired goal of a great ambition or darling hope, must be short-lived. The system cannot be robbed of its sleep without a corresponding disturbance and derangement of the functions; the power and the equilibrium of the vital forces will become so far affected, as to involve disordered action; and thus indirectly by forming part of the common organism, and directly by the diminished tension of the vital forces which supply the sensorium itself, the mind will become unable to continue its exertions. Many an ardent and hopeful aspirant for collegiate distinctions, many an anxious labourer for professional eminence, has thrown away his hopes in thus vainly struggling to cheat the system of this great requirement.

I have said that the constitution of individuals modifies the amount of sleep which they require. The delicate-fibred, the feeble, and the nervous, require more sleep than the muscular, the powerful, and the unailing. The debilitated offspring of the sedentary, the voluptuous, the scantily fed, or the aged, require more sleep than the vigorous child of the active, the temperate, the plainly but well fed, and the youthful.

It has been observed, that the health of an individual greatly modifies the amount of sleep which he stands in need of. The more weakly, the more languid, or the more irritable, the state of the system, the greater the amount of sleep that is commonly needed. The more lethargic, or the more strong the individual, the less of sleep that should be taken. The kind of disease that may be present, is often found to influence the amount of sleep which seems to be needful; but generally, the diseases which interfere the most with the uses of the system as to sleep, are the most likely to lead to irreparable injury to the health. In some cases, disordered action interferes with the sleep to the extent of fearfully aggravating the wearing effects of the disease, and increasing the risk of a fatal issue to the ease in a corresponding degree. The restoration of a sufficient and perfect sleep, is often the first indication of the diminution of morbid action and the approach of convalescence.

The kind of food that is made use of, modifies the amount of sleep which is required. Animal food renders

more sleep necessary than vegetable food ; and those persons who sleep much—too much in proportion to their constitutional powers, and to the amount of exercise of mind or body that is taken, and in whom this cannot be attributed to temporary influences or actual disease—may do well to think whether this may not be owing to the quantity of animal food which they consume ; and should there appear to be some reason for such an opinion, may wisely try the effect of diminishing the proportion of animal food consumed by them. In extreme cases of this kind, they may be wisely directed to make use of an exclusively vegetable diet for a time. It is a no less useful observation, that many cases of defective sleep, particularly in the invalided, are more or less relievable by the use of a larger proportion of animal food : supposing such a higher dietary to be otherwise unobjectionable. The unnecessary indulgence in the use of malt liquors, or of wine or spirits, is a common cause of an excessive amount of sleep. This is truly stealing from one's days, and recklessly throwing such time into the waters of an unrequiting oblivion. Excessive sleep, moreover, induces torpor and derangement of the bodily functions, and debilitates the system in the same proportion. The effect of excessive sleep on the mental faculties is no less serious. It dulls the sensibilities, and weighs down, warps, and impairs the imagination, the judgment, and the memory.

The time required for sleep, evidently varies much ; seven or eight hours may perhaps be said to be the usual average ;—the young, and the feeble, and the

ailing, requiring more, and some strong and healthy adults requiring less. Usually, less sleep is required in summer than in winter, in this climate. In warm climates, or during very hot weather, the vital forces become so rapidly expended, and their equilibrium is so soon disturbed to such a degree, that the system cannot continue its labours without discomfort and disadvantage, during the sixteen or seventeen hours; and the same remark applies to invalids and very delicate and feeble individuals, in any climate. Under such circumstances, a midday sleep seems to be useful and necessary.

The night time is evidently intended as the proper period for sleep; and the adage which tells us that "early to bed and early to rise" are conducive to health, is for the most part, if received with some qualifications, sound and good. In these higher latitudes, to rise with the sun at the different times of the year, would interfere with the regularity of habit, by a moderate attention to which the health of mankind is known to be so much promoted, whether in regard to food, or exercise, or sleep, &c. Moreover, in the earlier hours of morning, at all times of the year, the air is apt to be charged with the dampness and probable impurity of the terrestrial exhalations, which must render exposure to the air at such time somewhat less wholesome. This observation would, however, seldom apply to more than the first or second hour after sunrise. Generally speaking, the going to bed at such hours of the evening as will have left an adequate time for sleep before the hours

of six, seven, or eight o'clock in the morning, at the different seasons of the year, is what is evidently, in this country, the most conducive to health.

I may conclude this chapter by mentioning more particularly, some of the more important causes of sleep and of wakefulness.

A moderate and adequate exercise of the faculties of the mind, not only renders sleep more necessary, but puts the system into that state in which sleep is most likely to occur, and to be tranquil and refreshing in its character. An immoderate use of the mental faculties excites the nervous system in an undue degree, superinduces irritability, and either altogether prevents sleep, or renders it uneasy, partial, dreamy, and rather exhausting than cordial in its effects. If the mind be not only exercised unduly, but the depressing passions of grief or anxiety be likewise at work, the effect is largely added to.—

“Sleep, gentle Sleep,
Nature's soft nurse, how have I frighted thee,
That thou no more wilt weigh my eye-lids down,
And steep my senses in forgetfulness ?
Why, rather, Sleep, liest thou in smoky cribs,
Upon uneasy pallets stretching thee,
And hush'd with buzzing night-flies to thy slumber ;
Than in the perfum'd chambers of the great,
Under the canopies of costly state,
And lull'd with sounds of sweetest melody ?
O thou dull god, why liest thou with the vile,
In loathsome beds ; and leav'st the kingly couch,
A watch-case, or a common 'larum bell ?
Wilt thou upon the high and giddy mast
Seal up the ship-boy's eyes, and rock his brains
In cradle of the rude imperious surge ;
And in the visitation of the winds,

Who take the ruffian billows by the top,
 Curling their monstrous heads, and hanging them
 With deaf'ning clamours in the slippery clouds,
 That, with the hurly, death itself awakes ?
 Can'st thou, O partial Sleep ! give thy repose
 To the wet sea-boy in an hour so rude ;
 And, in the calmest and most stillest night,
 With all appliances and means to boot,
 Deny it to a king ? ”

SHAKSPEARE.—*Henry IV.*, Part 2, Act 3, Sc. 1.

Tranquillity of mind is one of the best of sleeping draughts,—the surest and most effectual plea that can be offered in the court of Somnus ; whereas sleep is driven away by a memory over-busy in recalling the past, especially if the picture be of dark and sombre character,—or by a busy imagination, delineating a gloomy future.

Darkness favours sleep, and light is unfavourable to it. Those sounds which are loud, discordant, and irregular, are usually great preventives of sleep ; while the sounds that are low, musical, and regular, almost always assist it. It is well known, that the hum of bees, the murmur of running waters, the swelling and falling tones of music, and even the unvarying tones of a drawling speaker or reader, induce sleep ; and the sleeper is often found to awaken when such sounds are discontinued. An ancient remedy suggested for sleeplessness, was to let water fall from some little height, drop by drop, into a metal pan, the regular and monotonous tones of which might induce sleep. Provided that the sounds be at regular intervals, whether they be near or distant, loud or low, musical or harsh, seems, after

some little usage, to have little effect of interfering with the sleep. The loud and dissonant but measured clanking of the heavy hammers of large forges worked by steam power, are not found to interfere with the sleep of those accustomed to such neighbourhood. The uninterrupted sleep of those who occupy the houses in the great thoroughfares of busy and populous cities, illustrates the same fact; as does the sleep of the seaman in the storm-tossed ship, notwithstanding the violent rocking of the vessel and the creaking of the cordage. Certain odours, as that of freshly gathered flowers,—particularly such as have a faint fragrance, rather than a powerful smell,—have often been observed to induce sleep. The praises that have been so often lavished on the sleep-inviting merits of a bed of heather, may perhaps be referred to this head. The odours of the violet and the mignonne appear to be of this kind. The narcotic virtue ascribed to a pillow filled with the petals of the poppy flower, is probably due to their faint odour, rather than to the infinitesimal doses of morphia, which they may be supposed to exhale along with their fragrance. Some people appear to be remarkably affected in this way by certain odours. The sense of touch—the last of the external senses that is found to yield to sleep, and the first to shake off its trammels,—influences sleep in an important degree. Contact with hard, or rough, or cold substances, has sometimes the effect of inducing sleep, but more commonly either renders the sleep imperfect, or chases it away.

As it is in the organic functions alone that signs

of life are left, when perfect sleep has locked up all the other functions of the nervous system, so the principal preventives of sleep are derived from their derangements. Digestion in its different stages, the circulation of the blood, the respiration, the secreting and excreting organs and tissues, if defectively carried on, may modify or prevent sleep.

In the earlier stages of digestion, owing to the larger quantity of blood that is then directed to the stomach, and the larger amount of nervous power that has then to be supplied to that viscus, the powers of the mind become in a greater or less degree more sluggish, and the will to exert either mind or body is more or less diminished. The degree to which this obtains varies much, according to the quantity and the kind of food that has been taken, and according to the tone and healthiness of the stomach and the general system. In the later stages of digestion, on the contrary, some degree of buoyancy, and an aptitude for any or every kind of work, intellectual or bodily, usually comes on; and this is followed by some degree of languor or restlessness, and this by an appetite for another meal. It might be supposed from these premises, that it would be well to sleep immediately after the meals, and so interfere as little as might be with the determination of the vital forces to the chymification of the food. Experience shows that such a proceeding would be wrong under ordinary circumstances. It is admitted, that sleeping during the first stage of digestion accelerates and facilitates the digestive process; and the digestive

powers may be so weak, that, without such aid, the stomach may not be able to digest even the lightest, and simplest, and smallest quantity of food. Under such circumstances, or in minor degrees of such conditions, the indulgence of sleep after the meals may be most justifiably prescribed; but unless in some such states of system, the practice is found to hurry forward unduly the first stages of digestion, to cause the food to pass from the stomach into the bowels prematurely and crudely, and to produce some degree of excitement and feverishness of the system when the person awakes, and to involve a risk of eventual irritation and derangement of the bowels. In general, even in dyspeptic cases, and in feeble conditions of the system, when not of very severe or extreme character, simply sitting still for a longer or shorter time after the meals, fulfils every needful intention, without risking eventual derangement of the intestinal functions. It may be added, that the common practice among the studious, of devoting those moments of buoyancy and vigour which commonly follow the completion of the first stage of digestion to any sedentary occupation, is anything but advisable for the dyspeptic. Those are emphatically the golden moments which should be devoted by dyspeptics to exercise of the body; promoting, as muscular exercise is admitted to do, the action of the liver, the elimination of the chyle and its conveyance to the current of the circulation, and the propulsion of the egesta through the bowels. In the larger number of those who lead sedentary lives, but who may not

be so far out of health as to be justifiably reckoned as dyspeptic, this particuar time after a meal, once a day,—and the hour or so after breakfast might for many reasons be preferred,—should be chosen as the best for the purpose of bodily exercise. In a much more advanced stage of the digestive processes, when the food has reached the large intestines, it is very often troublesome to the dyspeptic invalid; and when this happens, it proves a common cause of rendering the sleep disturbed or imperfect. How commonly does the dyspeptic awake about two or three o'clock in the morning, in a state of feverish restlessness, with a parched tongue, a dry skin, a burning heat of the palms of his hands and the soles of his feet, and perhaps an obscure sensation of undue sensibility, or perhaps a more marked sense of uneasiness, or even pain, in the bowels? This is usually the consequence of some error in the diet of the previous day; and perhaps in general, of some imperfectly digested article of food that has been eaten at supper:—

“Oppress not nature sinking down to rest,
With feasts too late, too solid, or too full.”

ARMSTRONG.

It has indeed been said by various writers, that the general abandonment of the practice of eating a hearty meal of food at supper time, the heaviest meal having been taken at noon or soon afterwards, may affect the probabilities of sleep disadvantageously. It has been urged, that the interval of four or five hours between the heaviest meal of the day and the

time of going to bed, offers by no means the most favourable period for going to rest, or sleeping soundly and tranquilly; that the early stage of digestion is passed over, during which there is the natural tendency to repose; and that when we dine at six P.M., and go to bed at ten or eleven o'clock, we seek to sleep at a time when the system, as respects the influence of the food upon it, is taking up again a more active state, and when active muscular exercise is expedient to forward healthily the latter stages of the digestive process. This would be a good argument, were the time required for sleep limited to the three or four or five hours needful to the primary processes of digestion, and if it were not proved that sleep is apt to hurry these processes unduly, and to lead to their being imperfectly performed. As it is, the eater of suppers may be more likely to sleep during the early hours of the night, but is assuredly more likely to pass the remaining hours of bed-time in broken and imperfect sleep, or in a state of restless wakefulness. So far as the valuable result as to health and physical comfort, of taking the greater part of the required daily sustenance in the earlier part of the day,—making the breakfast and the dinner to be virtually almost the only meals, and taking the dinner as early as may be in the day,—enough has been said in the first chapter; and neither the man of sedentary habits, nor the invalided, should take more food thereafter than consists with satisfying the cravings of the stomach; and the food taken thereafter under these circumstances, should be of the kind that is least

likely to derange the economy, by passing in a crude and imperfectly chymified state into the bowels. In cases where the sleepless condition appears to be more or less referable to an undue inanition; and in which, accordingly, the use of food some short time before the bed-time evidently promotes the probability and the perfect character of the sleep, the risk of subsequent intestinal derangement from the passage of crude aliment into the bowels should be kept in view, and the kind of food made use of at supper be looked upon with some degree of jealousy. These, however, are usually cases of long continued disorder of the digestive organs, referable to much unwise neglect of muscular exercise, and often to the further disadvantage of the use of injudicious food, selected to pamper the capricious and defective appetite; the system being unable to assimilate a sufficiency of such ingesta to supply the positive wants of the economy, unless food is taken frequently during the hours when any degree of exertion has to be undergone. The radical treatment of such cases must involve a fuller attention to the means of hygiene; and an exact obedience to the organic laws may commonly render the need of a further supper than a little bread or biscuit to be no longer felt, even for the purpose of securing sleep.

The cause of sleeplessness, or of an oppressing, overpowering, and enfeebling sleep, is frequently to be found in the state of the circulation. If the blood is driven with unwonted rapidity through the vessels of the brain, restlessness is very liable to ensue; and

if such rapidity of vascular action is still further increased, that restlessness usually passes into a profound, lethargic sleep, which exhausts and still further deranges the balance of the vital forces, instead of proving to be refreshing and restorative. To render the sleep perfect, the blood must be equally circulated; neither this part nor that being furnished with more than its customary and natural proportion. So far as the effect of the great respiratory function upon the character of the sleep, the importance of a full oxygenation of the blood, to this and all the other processes and necessities of the system, has been previously noticed. The probable consequence of an imperfect aëration of the blood upon the sleep, is to render it imperfect and much disturbed in the first instance, and eventually lethargic. Cases of pulmonary disease, equally with those that are simply dependent on imperfect ventilation of the bed-room, illustrate this.

Disturbed function of any of the great secreting organs, almost always either prevents sleep, or renders it imperfect; producing irritation of the nervous system, and interfering with the absolute repose of the intellectual and the motor powers, and in some cases even of the external senses. But the less perfect the sleep, the less of nervous energy does it restore, and the less does it advantage the sleeper:—

“A sleep without dreams, after a rough day
Of toil, is what we covet most.”—BYRON.

Such deranged condition of the great organs often

interferes mechanically with the due passage of the blood through their tissues, and thus obstructing more or less the general circulation, may so far oppress the vascular condition of the nervous centres, as to render the sleep imperfect or lethargic. The mechanical influence of an overloaded state of the bowels, or a congestive condition of the liver, &c., may often sufficiently explain disturbed sleep.

In the case of the invalided, sleep may often be induced, or tranquillised, or relieved from its lethargic character, by directing the surface of the body, locally or generally, to be sponged with cold, or tepid, or warm water; by directing the feet and legs to be fomented with warm water; or by directing the application of cloths, wetted with cold or warm water, according to circumstances, to the forehead and temples. These often prove to be sufficiently energetic sedatives, and are simple and safe means of procuring sleep.

To secure sleep, then, the mind must be tranquil, its powers moderately used, but not over-worked, and its several faculties kept in proper subjection to one another; the muscles of voluntary motion must be duly exercised; the stomach kept free from disturbing influences; the circulating and respiratory organs, and the several organs of secretion and excretion, must all perform their respective duties without appreciable inconvenience:—

“ Vivitur parvo bene, cui paternum
Splendet in mensâ tenui salinum,
Nec leves somnos timor aut cupido
Sordidus aufert.”—Hor. Carm., Lib. ii., 16.

To promote sleep, the bed-room should be well ventilated, and rather cool than unduly warm; the bed should be somewhat hard; the head should be somewhat elevated; the feet should be kept warm; the bed-clothes should be sufficient to maintain the bodily heat, without unduly confining it; and the bed-room should be darkened, and the surrounding silence should be perfect.

In the words of Dr. Gregory,—and they are a fit conclusion to the subject, and convey an important lesson to the gourmand, the intemperate, and the slothful,—“Light and perfect sleep is the reward and the solace of labour, virtue, and temperance, and it is not readily granted to the undeserving.”

CHAPTER IX.

On the Effect of Occupations upon Health.—Sanatory Influences of Locality, Ventilation, Drainage, Temperance, &c.—Effect of Confinement, Sedentary Habits, Constrained Positions, Over-Exertion, Prolonged Labour, Undue Use of the Voice, Undue Use of the Eyes, Damp Places of Work, Hot Places of Work, The Inhalation of Dust, Exposure to Weather, Loss of Sleep at Night, The Mineral Poisons, &c., on the Healths of Handicraftsmen, Miners, Labourers, Seamen, &c.—Importance of Manly Sports, Public Pleasure-Grounds, &c., to the Health of the Sedentary and Operative Classes of the People.

THE influence of the employment or occupation on the health, and consequent probabilities of life, and on the nature of the diseases by which the duration of life proves to be eventually affected, is unquestionably very great; although it may not be so great as appears to be commonly supposed. What is observed by M. Louis, in his so deservedly distinguished "Researches on Phthisis," in regard to the effect of trade and occupation in the development of that disease, may be applied, with much truth, to the general question of the influence of occupation on disease and mortality. "The truth is, that it is necessary to take a multitude of circumstances into consideration, in the attempt to determine the influence of professions in the development of the disease, —circumstances so important that, without them,

the closest analysis of cases could not lead to other than erroneous conclusions. The artisan does not live only in a dry or moist, cold or hot atmosphere; he does not breathe only inoffensive or deleterious vapours; he does not follow only a sedentary or active trade, &c.; his trade further requires a great outlay of strength, and a vigorous constitution, or those who pursue it are weakly, and constitutions of this stamp suffice for its duties; again, the wages of the artisan allow him, or do not allow him, to procure good food, and a healthful lodging, &c. &c." There can be no longer any doubt, that such several circumstances as are involved in the condition of a healthful lodging, a regular supply of good food, and habits of temperance, have much more to do with the probabilities of life in almost every occupation, however otherwise reputed unhealthy, than such occupation inseparably involves. The shoemaker, or the tailor, or the weaver, is infinitely more likely to suffer in health and life-expectancy, from the deficient ventilation of the workshop, and the defective drainage and sewerage and ventilation of his dwelling, than from the sedentary nature of his employment, or the constrained position in which he is obliged to sit during so many hours of the day. The glass-blower, whose occupation exposes him to such extreme alternations of temperature, and the remark applies equally to many other trades and occupations, is more commonly found to suffer from his own habits of intemperance, than from the consequences of such alternately heated and cool air, interfering with the

balance of the circulation, and the just condition of the several emulging tissues and organs. Habits of excess, and the neglect of a strict attention to personal cleanliness, have probably more to do with the unhealthy condition, and the shortened lives, of those who follow the different trades in which lead or mercury are extensively used, than the poisonous influences of those metals would otherwise be enabled to exercise.

Before the effect of occupation on human life can be rightly estimated, it is needful, then, to deduct those differences between the value of life in the more largely acting social circumstances of locality, ventilation, drainage, temperance, &c. If the expectation of life among artisans and their families, is less by one-third than that among the tradesmen and their families in the worst districts of the larger towns, and considerably less than half that of the families of the gentry; and if a somewhat less difference, but still a very large difference, as to the expectation of life, exists among the different classes of inhabitants of rural districts;—the causes of such difference are found to be in operation from the earliest ages of the children, long before the specific occupation could have exerted any directly deleterious influence. Thus, we find the largest difference in the respective mortality of the three great classes of the population, to obtain under five years of age; the differences in the respective mortality of the classes, becoming necessarily less and less as life advances, although continuing to be so considerable, that the expectation

of life in a labourer's family in the county of Wilts or of Rutland, is not nearly so great as that of the families of the gentry or professional persons in Manchester, Leeds, or London. All this is greatly due to larger and better houses, a better house-ventilation and street-ventilation, better drainage, more temperate habits, and a fuller exercise, and more equable exercise, of all the faculties of body and mind. "An impression is often prevalent," writes Mr. Chadwick, "that a heavy mortality is an unavoidable condition of all large towns, and of a town population in general. It has, however, been shown that groups of cottages on a high hill, exposed to the most salubrious breezes, when cleanliness is neglected, are often the nests of fever and disease, as intense as the most crowded districts." In the city of Geneva, although the population has doubled in the course of two centuries and a half, the expectation of life to every individual born, is increased by more than five times; the probabilities of life to every individual born having been, according to the public registers, about eight years and a half, towards the end of the sixteenth century, and about forty-five years between 1814 and 1833. The rapidly diminished and diminishing mortality, and the greater healthiness as well as expectation of life, which obtain in all countries, and in every one of the towns and districts of this country, where drainage, ventilation, and cleanliness, have been in any efficient degree attended to, afford irresistible proof of the importance of carrying out these great means of increasing the life,

and happiness, and usefulness of man, to the fullest degree.

The deteriorating influence of employments on the health, may be referred to the confinement to the house, to the insufficient ventilation, to the sedentary habits, to the constrained and unnatural character of the position in which the workman sits or stands, to the degree of heated atmosphere in which he has to pass his working hours, and to the poisonous influence of the metals, &c., used in his occupation.

The collecting large numbers of work-people into the same apartment, or into the same building, is necessarily disadvantageous to their health, even if the drainage of the building, and the ventilation of the rooms, be attended to in the best manner: it need hardly be said, even much more disadvantageous to their health, if such means are not fully attended to. In workshops and workrooms, in factories, and in mines; among tailors and milliners, among weavers, spinners, &c., either in silk, cotton, or wool, among calico-printers, among lace-makers, or net-makers, among founders and smelters, among smiths, among glass-blowers, among potters and pipe-makers, among gilders, &c., &c., the evils of collecting people together, and confining them in a common building during a large portion of every twenty-four hours, are great, and in some degree, irremediable.

Generally speaking, the hotter the places of work have to be kept, for the special purpose of manufacture, or as a consequence of its processes, the greater the evil effects on the health, and the greater the

care that should be bestowed on the ventilation of the places of work, and the greater the attention necessary to the clothing and habits of life of the work-people.

But, however great may be the care bestowed, so far as the results hitherto obtained from it, the health of those who work together in the same building in large numbers, is never on a par with that of those who work in detached dwellings. The weaver, or the stockinger, or the lace-maker, or the embroiderer,—miserable as may be the weekly pittance they can earn, and poor and close their dwellings, and undrained and filthy the surrounding lanes and courts,—if following their several occupations in their own houses, may very generally be distinguished from the factory operatives, by their firmer frames and less worn countenances. When the degree of ventilation is made equal to the numbers of work-people collected together, and when the labour of young children is entirely forbidden by the legislature, the evils of the factory system may be reduced to a less important position. I write of things as they still exist; notwithstanding all that master-manufacturers have endeavoured to effect for their work-people; and notwithstanding the occasional interposition of commissions of inquiry, and acts of parliament.

The evils that attend the employment of children in the various manufactures, can only be removed by prohibiting the practice altogether. The years of growth, when so much of the vital force is needed

to further the increasing size and development of all the organs and tissues, will not bear the wear and tear of mechanical employment, however little laborious may be its character, if continued day by day during a sufficiently long time, to be of importance to any manufacture, without laying the train for future evils, of no secondary degree, to the healthiness of the life, and its probable duration. Even in the instances of children, following such employment by the side, and under the eye and control of their parents, their strength has been found and proved to be severely, and injuriously, and pitilessly expended; and if such cases do not afford a sufficient guarantee against cruelty and wrong, it may be safely urged that there can be no possible circumstances in which the labour of children can be justifiably made use of. It need not be added, how wisely these precious years of the young life might be spent, in sowing the seeds of a religious and moral and intellectual education, in affording the surest safeguards against future depravity, the best preservatives against crime, and the only means of elevating the character, and lessening the dependence on sensual indulgence for the means of happiness. In the case of girls, these invaluable years, now worse than thrown away in factory-labour, or some routine manipulation, might be further occupied in teaching the future woman, wife, and mother, the great domestic arts; making her fit to fulfil her needful duties as a poor man's wife and help-mate; instructing her to eke out the little earnings in the best ways,—familiarising her with the

principles and practice of cottage-cookery, and all the duties of good housewifery. At or after the age of puberty, both boys and girls may be properly expected to earn their own living; and, when socially cared for by proper sanitary regulations, however humble their lot, however small their earnings, however hard their toil, however poor and meagre their food, however poor their dwellings, legislation will have done very much on their behalf, and they will be safely said to have placed before them more than a chance for happiness.

The tailor, the shoemaker, the weaver, the sempstress, the compositor, the engraver, and all the more sedentary occupations involve more or less injury to the health, from the constrained position required for the employment. In the younger and more delicate, and on this account particularly in young females, the physical evils include deformity of the spine, and possibly of the chest; in the older and stronger, they are confined usually in the first instance to the various kinds, degrees, and consequences of indigestion. Eventually, in a very large proportion of those who become victimised to neglect of the organic laws, whether such neglect proceeds from wilful inattention, ignorance, or an imperious necessity, the disordered action becomes extended to the respiratory organs; and the fatal issue may be most usually referred, more or less directly, to the supervention of phthisis.

Confinement and sedentary occupation are the principal causes of the diseases of artisans; but

they are not the sole causes of such diseases. A cause which sometimes obtains, but in an infinitely less degree of frequency, and in a less degree than may have been commonly supposed, is over-exertion ; the undue use of a part or the whole of the muscles of voluntary motion. For, if over-exertion should include the undue wear and tear of the *physique*, by unwisely prolonged labours, by a long and virtually unbroken day-by-day work, of twelve, fourteen, or sixteen hours, there can be no doubt that it has been proved to be a fertile cause of broken health and shortened life ; especially among the poor milliners, dress-makers, shirt-makers, &c., of London, and the larger towns of this country. Even in the much more limited and less important sense, however, of unduly violent muscular effort being required in the occupation, there is, no doubt, injury to the life-probability incurred by those who work at some of the more laborious employments, such as smiths, ballasters, miners, &c. This may be referable to such strains as may induce herniæ, or aneurisms,—or to the laborious efforts so far and so frequently interrupting the circulation, as to superinduce disease of the heart,—or to the immediate consequences of violent exertions in causing displacements of the vertebræ.

The undue use of the voice, whether in singing or public speaking, and the undue exercise of the lungs in blowing wind-instruments, &c., are said to be not unfrequently productive of disease. If the chest be constitutionally delicate, whether from congenital

peculiarity or hereditary predisposition, or the various physical circumstances which have acted on the system during the years of growth, such causes might well be sufficient to produce or confirm pulmonary disease; but, otherwise, it may be doubted how far the use of the lungs in freest vocal exercise, after the age of puberty, can be otherwise than invigorating to the pulmonary tissues, and so far preventive of pulmonary cachexia.

The undue use of the eyes is a fertile source of evil to many classes of the children of labour. All who have to fix their eyes on minute objects, as engravers, compositors, watch-makers, embroiderers, painters; all who have to work much by artificial light, as dressmakers—particularly if much employed in sewing black articles,—students, and literary men; all who have to expose the eyes to the influence of strong light, as workers at forges and furnaces,—are found to be peculiarly subject to disorders of the eyes, and defective vision, with much risk of eventual amaurosis, or loss of sight from paralysis of the optic nerve.

Those who work in damp places, as colliers, and miners generally, who usually, moreover, have to labour in a position that is nearly or absolutely horizontal, and perhaps with part of the body immersed in water during days or weeks at a time, are peculiarly liable to suffer injury from their employments. Those who work in rooms which are either very much heated, or subject to great vicissitudes of temperature, as glass-blowers, calico-printers, dyers, the operatives

in certain factories, &c., are correspondingly liable to suffer from their employments; and more particularly, it is said, from disease of the liver. In the instance of bakers, there must be added to the deleterious influence of the heated ovens, that of the fearful consequences of so much night-work as is commonly required, and, moreover, the bad effects of inhaling so much dust as arises from the flour.

The mechanical effect of dust, when respired to a considerable extent, is seen in the liability of the grinders of cutlery, of stonemasons, &c., to pulmonary disease. Needle-makers, pin-makers, colliers, flax-dressers, and those who work in some of the branches of the cotton and worsted manufactures; also glass-cutters, file-makers, whitesmiths, and the artisans in many other departments of manufacture, are likewise more or less liable to suffer from the inhalation of the dust produced by their occupations. Dr. Favel says, that maltsters are very liable to chronic bronchitis, and eventual phthisis. Dr. Hastings writes, that the preparers of yellow leather, in the city of Worcester, and those employed there in some parts of the china manufacture, are often the subjects of severe attacks of pulmonary disease; the processes involving the inhalation of an atmosphere loaded with dust. "Dyspnœa is generally the primary symptom, which is often neglected for many months. If the occupation, under these circumstances, be continued, the disease is aggravated; the patient is not unfrequently seized with hæmoptysis, which is occasionally very profuse, and which is accompanied with

a great increase of dyspnœa and severe cough." It is added, that such cases may die from true tubercular phthisis, or from inflammation, thickening, and ulceration of the bronchiæ and the air-cells. Grooms, and the men employed in breaking stones on the public roads, are believed to suffer likewise more or less from this cause. The miserable class of grinders, in the various processes of the manufacture of cutlery, is the most fearful and notorious instance of the injurious effects that may follow the exposure of the pulmonary mucous tissue to such direct sources of mechanical irritation. According to the able account of this form of pulmonary disease, for which we are indebted to Sir Arnold Knight, fully confirmed in all particulars as this account has since been by Dr. Calvert Holland, and the late Dr. Favel, the so-called "grinders' asthma" is a true tubercular cachexia, necessarily modified in its progress and symptoms by the causes which produce it. The symptoms of the cases, and the *post mortem* examinations, show much irritative inflammation, superinducing bronchitis, peripneumonia, hepatization, and tubercular degeneration; the latter becoming, in many cases, eventually extended to the kidneys, &c. The fatal result of this fearful occupation, appears to be more rapid in those branches of the business in which the grinding is performed on dry stones, less rapid when the operative has to use dry stones for some parts of his work, and wet stones for other parts, and still less rapid when wet stones are exclusively made use of. The dry grinding branch appears to destroy the life,

at from 28 to 32 years of age; the mixed dry and wet grinding, at from 40 to 45 years of age, and the wet grinding at from 45 to 50 years of age (Sir Arnold Knight). Among the fork-grinders, out of 61 deaths, 44 were under 35 years of age, and one individual only had attained the age of 48: this is dry grinding. Among the scissor-grinders (mixed wet and dry grinding), of 102 deaths, 41 were under 36 years of age; in the four subsequent years (36 to 40), more than a fourth of the whole mortality occurred. Among the razor-grinders (wet and dry grinding), more than half the deaths occurred under 36 years; and three-fourths of the remaining deaths occurred between the ages of 36 and 45. The pen-knife grinders, the table-knife grinders, the file grinders, the saw grinders, and the scythe grinders, present varying rates of mortality, according to the probable degree of mechanical irritation of the pulmonary tissues: in the instance of the scythe grinders, of 20 deaths, 12 were found to have occurred between 46 and 60 years of age, and only 3 of the number had died under 41 years of age (Dr. Favel). It seems, that, in all these cases, the irritation is due to the inhalation of the minute particles detached in the grinding; and more injurious effects are attributed to the particles detached from the grinding stones, than to those from the steel; and, therefore, the ingenious apparatus invented by Mr. Abraham, consisting of a mask of magnetised iron, even if the reckless workmen would have taken the trouble to use it, would have been of comparatively little service,

as it could only have arrested the particles of iron ; and could only have been thus far useful, when a single grinding wheel was in use in an apartment, whereas several wheels, in use by as many men, are generally at work in the same room. A more useful, and much simpler contrivance, seems to be an open flue, on the side of the wheel opposite to that on which the workman is placed, through which a sufficient current of air is kept up, from within the building to the outside, by means of a fan, kept in motion by means of a strap connected with the revolving wheel. It is said, that, although the construction of such flues does not cost, on the average, more than £2 each, and although their effect on the atmosphere admits of the easiest demonstration, their use is by no means general. Sir Arnold Knight says, that "the men themselves will be at no trouble about their own health," and that he "almost believes they view any precaution to prolong life with jealousy, as a means for increasing the supply of labour and lowering wages."

I have selected this great instance, on account of the convincing evidence it affords of mechanical injury which may be inflicted on the lungs by the habitual inhalation of dust : a proof which is strengthened by the circumstance, that when the grinding-wheels were worked by water-power, and the workmen were subject to long interruptions of their work in times of frost or drought, and when the grinding part of the edge-tool manufacture was followed in connection with the other departments of the trade, the

grinding occupying only a certain portion of a man's time, the grinders' asthma was not of sufficient importance in the amount of its effects to attract attention. In the instance of this occupation, however, as well as in that of most others that are specially characterised by a much shortened life, the fatality must be referred in part to the reckless intemperance of the artisans themselves. The habits and moral condition of these grinders, on the testimony of all the medical writers, are fearfully sensual and depraved: drunkenness and low debauchery filling up the greater part of their unemployed time; and Dr. Holland says—and it is to be feared that the observation might be extended to other trades and occupations—"the more desperate the branch, the more ignorant, reckless, and dissipated are the workmen." In other occupations, the effect of inhaling various fine and irritating powders into the lungs, may not be so rapid in their effects; but they are believed to be fearfully powerful in shortening the life, and determining to pulmonary disease. "I have reason to believe," writes Dr. Alison, "that there is hardly an instance of a mason, regularly employed in hewing stones in Edinburgh, living free from phthisical symptoms to the age of fifty." The earliness at which pulmonary symptoms are liable to occur, or, perhaps, the degree of the liability to such disease, among those who work at the different branches of the mason's art, varies very much; being dependent upon the degree of exposure to the dust from the stone. Marble-polishers, and those who saw stone,

and those who finish or work it for the finer purposes of building, and those who quarry it, although liable to suffer respectively in different degrees, are commonly more subject to disease of the lungs, than those who work with unwrought or unfinished stone, or than those who are chiefly or exclusively engaged in building up stone which has been wrought by others.

Exposure to the influence of damp or wet, affects, in an important degree, the healthiness or otherwise of any occupation. Colliers, and miners generally, often suffer much from this cause, when due care is not taken to drain the mines efficiently. I have often met with cases in which these men have had to work in a bent and recumbent position, with part of the body constantly immersed in water, during successive months. The usual consequence has been a severe rheumatic condition, sometimes leading to disease of the heart, or of the great vessels. Exposure to a damp air, which is at the same time heated, as in many of the processes of manufacture, is even more immediately and necessarily prejudicial to the health; debilitating the system, increasing its susceptibility to atmospherical influences, giving rise to dyspepsia, and often leading to pulmonary disease.

Exposure to the weather is less prejudicial to the health, than when the effects of a wet air are connected with confinement, and the imperfect ventilation of a mine or a building. Yet, coachmen, carters, boatmen, &c., suffer as to their chances of health, and probabilities of life, from the constant exposure to the air, in all weathers and seasons.

It is certain, that many of the diseases from which these classes of the people suffer, are referable, however, to the intemperance of their habits, rather than to any other circumstance; and the much greater healthiness of agricultural labourers, who may be little less exposed to the weather, but who are necessarily and notoriously so much more temperate, may be admitted in proof of this. If exposure to the night air, and loss of sleep during the night-time, is the condition of the life, in addition to much exposure to weather, the evil effect on the health is found to be largely increased. The average illnesses and mortality of watchmen, night-porters, persons employed on the lines of railway, nurses of the sick, &c., afford full evidence of this; and the shortened lives of surgeons, whose practice is in the outlying rural districts, or otherwise involves a large amount of professional occupation in the night-time, supply the strongest testimony of the same kind. All who are called upon by the necessities of their vocation, to infringe any of the great organic laws, should be so much the more careful to fulfil all and every other condition of health and longevity; and the classes referred to, whose occupations necessitate exposure to atmospherical vicissitudes and influences in an extraordinary degree, and especially if the effect of night-work be added thereto, should be by so much more temperate, and lead in every way more careful lives.

The lives of seamen are much affected by the great exposure to weather, their occupation requires;

to which must be added, the effect of the night-watches to which they are alternately exposed. At the same time, the causes of injury to the health among seamen, are so many, and so important, that undue weight may be readily assigned to any of them. The frequent and rapid changes of climate to which so many of them are exposed; the deficient ventilation that probably prevails in nearly all ships, and which prevails to so great an extent in the larger number of vessels; the habits of intemperance which are still prevalent among so many sailors; the dietaries of many ships, which, if not deficient in the quantity of food, are often of a very unsatisfactory quality, and often consist, during many successive weeks, of salted meat and biscuit,—which are not seldom, it is to be feared, in a very bad condition, from having been kept too long, or kept in a damp place,—and which, however good in quality, require to be mixed with fresh, and less azotised, and more aqueous food, for the maintenance and security of health; such are some of the many causes, which aid in deteriorating the healthiness of the lives of seamen; and, when the importance of such causes, severally and collectively, is considered, the wonder is that the lives of seafaring men should be even so far healthy as they are. The marine atmosphere,—the freedom of the air far out at sea from any possible terrestrial emanations,—the comparative freedom of the mind from cares or anxieties, unless during rough weather, or in certain more intricate and difficult passages of the wide waters,—the steady and disciplined occupation,—

and the commonly sufficient, and only occasionally severe, muscular exertion—may, however, collectively considered, serve to account for the degree of healthiness enjoyed by mariners, notwithstanding the commonly deficient ventilation of the between decks, notwithstanding the great and sudden changes of temperature to which they are exposed, in passing from the berth to the deck, or to the rigging, notwithstanding frequent changes of climate, &c., &c.

The different occupations in which men are exposed to the effect of mineral or other agencies of deleterious or poisonous character, remain to be noticed. Of these agents, lead and mercury are the most important. The painter, plumber, &c., suffer from the effects of lead. The earlier risk incurred from exposure to the effect of lead, is torpidity of bowels, debility of the muscular system generally, and eventual colic, with abdominal inaction; the less early risk is the increase of the muscular debility, or rather of the imperfect command over the muscles of organic life,—and, finally, of the command over those of voluntary movement, that is exercised by the nervous system,—and partial paralysis, great vital depression, and much functional derangement. These symptoms sometimes arise, and may prove to be difficult of explanation, or remain unaccounted for, when the water made use of in the dietary contains lead in solution.

In the instances of those who have to make use of the salts or oxydes of lead, or to inhale the fumes of lead, in the course of their employment, the

remedies are to be found in a rigid degree of personal cleanliness,—especially avoiding the taking of food with unwashed hands; in washing the hands, &c. with a largely diluted mixture of sulphuric acid and water; and in the use of such means of ventilation, and such efficient flues, as may obviate, as far as possible, the inhalation of its deleterious emanations.

In the instance of the trades where risk is incurred from the inhalation, or introduction through the skin, of mercury, or its fumes, a more particular degree of cleanliness, a more studious ventilation, and a more scrupulous use of an efficient flueage, are needful, in proportion to the greater injury, or the more immediate injury, that is risked from this remarkable agent. Great debility of the nervous system, partial paralysis, broken health, and shortened life, are the fearful consequences of such introduction of mercury into the human system.

The fumes of arsenic, of iodine, of chlorine, of the mineral acids, &c., are sometimes the causes of injury to the health and life-expectancy of artisans, and others. The degree of their influence may be always much reduced, if not so much so as to render them virtually inoperative, by carrying away such fumes from the workshops, by means of appropriate and efficient flues. Druggists often suffer much in health, by the odour of narcotic drugs, or by the frequent handling of the mineral poisons. Ventilation and scrupulous cleanliness, might generally do much to lessen such risk.

Due attention to clothing,—efficient ventilation,—the carrying away dust, or poisonous fumes, by means of flues,—and habitual temperance,—are among the great means of diminishing the unhealthy character of different occupations. Scrupulous cleanliness of the persons and the clothing of the artisans, are of more importance in such occupations than in others; and to promote it, all work-shops, or work-rooms, should be provided with convenient means of ablution, as to soap, water, and towelling.

Such muscular exercise as involves the due use of all the muscles of the trunk and extremities, while it leads people into the open air, is a needful promoter of health in the cases of the sedentary; but it is little less important in the instances of such artisans as use the muscles unequally, even although it may be laboriously, in their occupations. Grounds for the more active sports and exercises should be scattered, at convenient distances, in different parts of the larger towns; and those whose wealth depends upon the toils of the labouring classes, could confer few greater boons, than in affording means and encouragement to out-of-door sports; separating them from the contiguity, influence, and temptations of gin-palaces or beer-shops. In cases where there may be convenient and sufficiently high walls, the old game of tennis might be wisely revived,—as in the yards of factories and other places of work; in other cases, the game of nine-pins, or that of bowls, or that of throwing the quoits, might prove to be best adapted to the situation. In cases where sufficient space could be

obtained, and in suitable seasons of the year, cricket, or golf, seem to be so far preferable, inasmuch as they afford more exercise of the lower extremities, and usually a greater degree of mental stimulus.

There is no doubt of the great value of open spaces for all such purposes, and for that of furnishing walks and ornamental grounds, in different parts of the larger cities and towns. These may not only be valuable as great natural ventilators of the air in "close-built cities pent;" not only useful, as supplying an incentive to walking; not only useful, as giving space and opportunity to the cricketers, or the golfers, or the players at bowls, or the throwers of the quoits; not only important, as affording the means of listening to music in the open air; not only important, as giving the opportunity of passing the summer evenings in dancing, to gladden and interrupt the duller routinism of the life's daily drudgery; not only useful, in supplying the means of studying the different trees, shrubs, plants, and flowers; but useful, in diffusing an acquaintance with Nature, an appreciation of her beauties, a love of her simpler and purer pleasures,—in lessening the temptations offered by the lower sensual indulgences, by teaching the greater value and the superiority of such higher means of happiness. It is certain, that to give the artisan and his wife and children the means of enjoying the open air, in the midst of plants and flowers, surrounded by the families of his equals and superiors in life, while some of his mates may be dancing, and others playing at manly sports, is to

elevate his moral nature ; is to impart so much of an honest pride, as to encourage self-denial in order to procure suitable clothing, &c., for himself and those dependent upon him ; is to diminish selfishness,—to foster the love for wife and children,—to make him a better citizen and a wiser man ; as well as to promote his health and prolong his life, to diminish the chances of widowhood and orphanage, to lessen the amount of pauperism, and improve the condition and prospects of the whole community.

CHAPTER X.

On Mental Culture.—Classification and Relative Development of the Mental Faculties.—Automatic, Motor, Sentient, and Mental Powers.—Propensities, Sentiments, and Intellectual Faculties.—Early Self-culture of the Mind.—Precocity.—Physiological and Hygienic Effects of Mental Culture.—Relative Effect of the Deficient, the Just, or the Excessive Use of the Propensities, Sentiments, and Intellectual Faculties, severally.—Conclusion.

THAT human health and the duration of human life are greatly dependent on physical circumstances, may hardly require additional proof or illustration. It is proved, that the inhabitants of the larger towns are shorter lived than those of agricultural districts; that those who live in close, ill-ventilated districts, have a shorter duration of life than those who live in open situations, and well-ventilated houses; that those whose occupations are strictly sedentary, have shorter lives than those whose employments involve some degree of muscular exercise; that those who pass most of their time in the open air, live longer than those who are confined to a workroom or workshop; and that those who work exposed to the light of day, live longer than those who work in feebly lighted situations, or where artificial light is needed. It is a further step on the same path, to find it

proved by statistical facts and universal opinion, that, as a premature use of the bodily powers enfeebles the system, leads to disease, and diminishes the expectation of life, so a premature use of the faculties of the mind interferes with the development of the physique, and lessens the probabilities of health, and diminishes the chances of length of days; to find, that, as to use unduly any of the motor organs is to diminish the power and capability of the motor system generally, so to use the intellectual faculties unduly is to abstract unfairly from the sentiments and propensities, and indirectly to interfere with the general balance of the mental capabilities, and derange so far their character and power,—that the faculties, sentiments, and propensities, must be severally and duly exercised, if the nature and powers of the mind are to be developed and elaborated as far as possible; to find, that, as health of body ministers to the degree of mental capability, to the soundness and character of the mind's powers, so the development of the mental powers by due exercise of the several endowments, promotes the healthiness of the physique, and increases the probable duration of the life.

In the instance of all animals, a longer or shorter time after the birth is needful, to mature the bodily powers, and enable them to endure their fullest amount of exertion. To call these powers into use prematurely, is always inexpedient, and often dangerous; is commonly attended with an impaired condition of the animal machine, which no subsequent

care may suffice to restore, which may greatly diminish the future powers of the animal, and may shorten the probable duration of its life in a material degree. These conditions are well known in the instance of horses. The horse, which is used early in life, hardly ever proves eventually strong, or capable of regular labour to the same degree, as it otherwise would have been ; nor even capable of the same amount of occasional exertion. Even if early and incurable lameness should not result, or if the frequent recurrence of lameness should not greatly lessen the value and usefulness of the animal, it will be usually found, that the horse which has been set to work prematurely, has neither the capability of carrying the weight, drawing the load, nor bearing the same duration of exertion at one time, nor does its time of usefulness prove so long, as would have been otherwise probable. So much is this the case, that it is seldom wise to use a horse regularly, or to put it to laborious work, till five or even six years old, which may be said to be one half of the average age of useful capability in this country, and probably fully a third of the average time of useful capability of the horse in any country, or under any circumstances. This illustration is pertinent to the case of man. If a horse which attains its full maturity of growth at little more than three years of age, which has the use of its limbs almost as soon as it is foaled, and which by training can be brought to the racing ground at two years old or under, is found to suffer by having to undergo much or continued labour until two years or more

after the growth of the animal is completed, how much farther may not the early exercise of the human physique, in continuous exertion, or sedentary occupation, be productive of injury, when the period of helpless infancy continues so long, and of feeble childhood so much longer, when the growth of the body continues through so many years, and the full maturity of the system is not arrived at before the twentieth or twenty-fifth year of life, according to circumstances.

The human system, during the years of infancy and early childhood, is feeble and fragile to the last degree: the bones are all largely wanting in the due proportion of earthy material for strength and resistance; the muscles are all flaccid; the tissues are all engaged in the two-fold duty of protection and elimination, not only so far as these are required to maintain the integrity of the constituent elements of the body, and secure the due discharge of the superfluities of a perfect and completed machine, but, besides these, are occupied in affording protection to an imperfect, a growing, a developing, and consequently highly vascular and mobile organism, and in removing the redundancies of so much more active an economy. The processes of circulation, respiration, and nutrition, are all engaged in the two-fold duties of maintaining the existing system, and ministering to its further growth and development; and the nervous powers, the condition and medium of all vital force, are, in the same proportion, occupied in ministering to the activity and due performance of

these great vegetative functions. Yet these great vegetative offices of the nervous system : called vegetative, because the functions of circulation, respiration, nutrition, and growth, are common to plants as well as animals ; even these functions, as every other manifestation of vital force, being directly ministered to by the nervous organism, and affording ground for inferential hypothesis that plants themselves may not be without so much of a nervous organisation : yet these functions of the nervous system have to be performed by the most imperfect, the least complete, and the last matured part of the nervous organism ; and may well be supposed to embrace a large proportion of its earlier capabilities. The degree of its powers, and the balance of its functions, are so easily expended and disturbed in the earlier periods of life, that the infancy is largely consumed in sleep ; by which any derivation of vital force from the vegetative functions is obviated, and the due balance of its endowments is maintained. Slowly and gradually, the nervous organism becomes capable of more and more exercise, and the balance of its powers can be maintained during a longer and longer period ; and the sleep is interrupted by longer intervals ; and more and more of the higher endowments of the nervous system begin to be displayed. The motor powers, the organs of sense, the propensities, and the dawnings of the moral nature, and of the intellectual faculties, gradually but slowly, become apparent, acquire development, are more strongly manifested, and continue to become

stronger and more matured, until the meridian of existence.

The vital forces of the animal system, however exercised and displayed, involve and require the use of so much of the nervous organism as corresponds to such display. Although the whole of the nervous organism may be assumed to be very imperfectly developed, and by so much less fitted for its general duties, at the time of birth, there is sufficient reason to believe, that, inasmuch as the organic nerves are necessarily more competent to their duties than the other parts of the nervous system, so the motor nerves may be developed the next to those in point of time, then the perceptive faculties, then the propensities, then the moral sense, and, finally, the reflecting and comparing faculties. It can hardly be necessary to add to this, that, although this may be the usual order of the successive commencing development of the different orders of nervous capability, their relative after-development varies considerably, under different circumstances. In fact, upon this showing, depends much of the principle, by which the results of moral and intellectual education may be explained.

There is an important inference to be drawn from the mutual relation of the different kinds of vital force, and their common dependence on the nervous organism, in its different parts, for their respective manifestation. As regards the mind, indeed, with all its mighty capacities, and instinctive hopes,—with all its grasp of time, and space, and size,—with all its creative powers,—with all its keen appreciation of

the wonders, the immensity, the grandeur, the beauty, and the harmonies of creation,—with all its sense of the good, the beautiful, and the true,—with all its apprehension of the immaterial,—with all its cognizance of a Creative, Omnipotent, Omniscient, and Omnipresent Spirit; it surely need not be said, that this great, thinking, comprehending mind, cannot be material in its essence, or but a quality of the matter it is connected with. But mind is manifested through the medium of matter, and is so far dependent on the integrity and character of such material medium. The common dependence of all the varieties of vital force on the nervous organism, illustrates the observation, that the due use of such of the vital forces as are under the control of the individual in a greater or less degree, stimulates and strengthens all the vital forces, much in the same way that the due use of the muscles of the extremities strengthens the muscular system generally; whereas the undue use of any of the varieties of vital force, exhausts and debilitates, not only the kind of vital force so expended, but the vital forces generally of the system, as well those that minister to the higher endowments, as those which minister to the mere vegetative functions. Hence, the undue use of the mental faculties, may so far rob the organs of the vital force necessary to the normal performance of their functions, as to interfere with and impede such performance; and the studious man, or the anxious man, becomes a dyspeptic; or the over-tasked child becomes enfeebled, cachectic, and the subject of glandular disease,

rickets, *et id genus omne*. Hence, the due use of certain of the varieties of vital force, may stimulate the vital forces generally, and promote the well-being and the healthiness of the whole economy; and social intercourse, intellectual excitement, or a moral stimulus, may remove dyspepsia, or rectify other states of organic indisposition; or the same result may follow from a long walk in the open air, or from music, or from dancing, &c.; or the digestion of easily assimilated aliment, or the due use of the motor organs, may react on the mental powers and manifestations, and be followed by greater energy of the intellect, greater powers of judgment, or greater capabilities of memory or imagination.

The infant is torpid during the greater part of the young existence; it sleeps, to restore and maintain the equilibrium of the vital force, to draw off as little as possible of such force from the great vegetative functions. By degrees, the instincts which first enabled it to swallow, taught it to desire and take food, to respire, &c., are aided by manifestations of the motor powers; and the infant tosses its limbs, not merely from organic sympathy, but by reason of the will. By degrees, the infant begins to use its eyes, to become sensible to variations of light, to discern objects, to become sensible to the impressions communicated through the sense of touch, to become cognizant of, and capable of appreciating different sounds. By degrees, the power of observing all around him, of noting the forms, colours, hardness or softness, temperature, &c., of surrounding objects,

becomes manifested; by degrees, the appetites and the passions, sufficiently distinctive in character from the instincts of earlier existence, enter on the scene; by degrees, the appreciation of right and wrong demonstrate the commencing development of the sentiments; and, eventually, memory, imagination, and judgment, severally afford indications of a further advance in the nervous organisation.

The Hygienic lessons to be learned from these physiological statements are of much importance. The infant, for a term that may differ somewhat in duration, according to the degree of congenital strength and development, is virtually the mere creature of a vegetative existence, with the addition of the needful instincts that lead it to desire food, that enable it to swallow, to respire, &c. The less that this condition is interfered with, and the less that the supervention of the next gradation in this curious series is hurried,—in the more delicate it might almost be said the more it can be retarded,—the stronger the probability of future health and vigour. To expose an infant to the influence of strong light, to surround it with bright colours, or with articles that present a variety of strong lights and shades,—to stimulate the ear with noises, or almost any loud sounds, even if they be of musical character,—to arouse the motor system prematurely, by such excitement as allowing the infant to sit up, or tossing it up and down, or swinging it about—must be wrong in the earlier weeks, or it may be even in the earlier months, of life. In the rearing of

those who are especially feeble, and delicate, and imperfectly developed at birth, the nursery should be much darkened, all noise should be strictly forbidden, the conversation of the attendants should be in tones scarcely louder than whispers, and even the low singing of the lullaby may be for the time interdicted; while the raising of the infant from the horizontal position, which is certainly not necessary for the taking off or putting on its clothes, if they are properly made,—and which is not needful for the purpose of the ablutions, nor for the administration of the natural aliment, nor for that of artificial food, should be strictly forbidden.

As life passes on, as the infant system becomes stronger, as the nervous organism becomes more and more developed, the same pains are to be taken to avoid the premature excitement of the opening faculties,—to keep back, rather than accelerate, the dawnings of the successive grades of automatic, organic, sentient, perceptive, and reflective faculties. It is not only because the physical and sentient organisation of the ear may be incomplete and morbidly irritable, that loud noises should be forbidden in the nurseries; it is not only because the eye may be less tolerant of light, and its delicate tissue more easily irritated, injured, and inflamed, that a darkened nursery is to be advised; it is not only because the bones are soft and gelatinous, the muscles flaccid and feeble, the tissues highly vascular, the joints deficient in firmness, and intolerant of pressure, that the vertebræ should not be permitted to rest

upon one another, nor the muscles of the back be called upon to aid in maintaining the infant in a sitting position, nor the use of the extremities to be encouraged; but it is that there is the further and equally important risk encountered, of an interference with the development of the nervous organism, and of abstracting from the probabilities of a vigorous constitution of this most important part of the system.

By degrees, the manifestation and development of motor power, of the sentient system, and of the perceptive faculties, are evidenced in the voluntary and uncontrollable movement of the extremities, and of the trunk of the body,—in the exploring and prying eye,—in the apt and attentive ear; and the nursing should gradually follow such progressive development, and the infant be more and more tossed up and down in the arms of the nurse, be allowed to look from object to object in a less and less obscured light, be soothed by nursery minstrelsy, and permitted to sit up during a little and little longer time on the nurse's knee; but all these advances should follow the evident indications of nature's requirements, and never precede, and perhaps seldom go hand in hand with them.

By degrees, the gradually dawning faculties will show the sense of what is customary and what is unusual, will distinguish between the tones of approbation and those of disapproval; and the moral culture of the little being begins from that moment. Then, the unwise indulgence, the needless harshness,

the inconsistent kindness or severity, may lay the foundation of good or evil in the future life, may influence the temper, and confirm or modify the disposition. And soon thereafter, in the order of time, the strict adherence to truth, the regulated temper, the unselfish disposition, the steady and mild controul, the consistent method, the scrupulous order, and even an occasional just severity, of the mother or her substitute, may subserve the great ends of moral education to a degree that can never be estimated adequately. And soon thereafter; still, in this, as in all other ways, following the natural indications and development of the physique; the first impressions of religion may be made, without parade and without obtrusion; and the mother's deep sense of piety, her reverential love of the great Giver of all good, her zealous endeavour to obey God's commandments, to fulfil His ordinances, to keep herself unspotted from the world, be imparted to her immortal child,—how mighty a responsibility the idea and the words imply!—more by the influence of her living example, than her direct precepts.

All this is antecedent to the education of the intellect; although thereafter they may advance together to the common advantage of sentiments and faculties. There is no lesson so valuable, so needful to the physical strength, to the bodily health, or even to the chances of intellectual power in the after life, as this—that intellectual education should be left, during the earlier years, to the natural efforts and investigations of the child himself, and should not be

aided by parents or teachers, or promoted by books and lessons, until long after the time when it is commonly thought to be necessary or advisable to commence the business of instruction. In very delicate children, I should be glad to see the age of twelve or even fourteen years passed, before this great means of expending the vital forces, and abstracting from the chances of ultimate health and strength, should be called into operation; in other children, the ages of six, eight, or ten years, may be the earliest periods at which children of corresponding strength of constitution, should begin to be, so called, educated.

The amount of information, the degree of intellectual exercise, the value of the knowledge obtainable, and the fact that the child has everything to learn, are all undervalued; or more importance would be assigned to the effect of the acquisitions, which may or must be made by a child, in every department of useful information, by the single aid of his own observation and intelligence; and less paramount rank and value would be assigned to the acquisition of the arts of reading and writing, of languages, &c. These are only auxiliary means to the primary exercise of observation and reflection, on the objects, circumstances, and events of the life,—to the intellectual result of receiving, digesting, and assimilating the ideas which may be derived from without, whether men, or events, or books, be the source from which they are directly imparted. The child who is passing his early years in the midst of an educated family,

living in a civilised community, observing facts and events, listening to opinions and their data, and comparing for himself, and directed, guided, and modified as to his own views, by the comparing faculties of those about him, is undergoing the best possible ordeal for future intellectual effort, even if no book be set before him until he arrive at ten or twelve years of age, and the meaning of the words "lesson" and "school" be practically unknown to him. Even if placed in a much less auspicious position for intellectual exercise and progress,—surrounded with the imperfectly educated,—the great pages of Nature being set before him with no able and ready interpreter at hand, to illustrate and explain their teachings,—the habit of self-culture and self-reliance is, nevertheless, more likely to be attained, if other circumstances are not unfavourable to these great acquisitions, than if the mind is prematurely taken from the field of its own efforts, and made to become, at too early a period, the creature of scholastic discipline: a sort of living machine, by which pages are committed to memory, facts and opinions learned by rote, and words virtually allowed to take the place of the things and the ideas they only represent, and may represent inadequately. The discipline of the intellect in the acquisition of languages, in the great science of numbers, even in acquiring the mechanical art of writing, and the mechanical elements of drawing and music, is by no means to be undervalued; nor is the information that may at the same time be stored up in the mind, to be omitted from the account; but, after all, the

self-culture, the self-reliance, the personal observation, inquiry, and deduction, tell more, or at least as much, on the ultimate powers and capabilities of the mind,—and affect, at least as much, its eventual relative position, and the character and degree of its powers over the minds of its fellow men.

If, however, the mechanical routinism of the scholastic discipline is to be deferred, in all cases, until at least six years of age, the moral education and controul should be pursued so much the more anxiously, and maintained so much the more steadily. And no better use could be made of these earlier years; even if such higher moral cultivation were not thus rendered more needful. And, cultivating the higher sentiments,—educating and developing the conscientiousness, the benevolence, the integrity, the love of truth, the domestic affections, the self-denial, the decision, and, above all, the faith,—no parent need fear, that these years, during which his child may not know one letter from another, will be thrown away; the soil is being weeded and watered; it is being warmed by the sunshine, and fertilised by the dews; and the well-fallowed land shall yield no less a crop, and the crop shall be of no poorer a quality, than that reaped from his neighbour's land, which may have been so differently dealt with.

In truth, what is it, after all, that constitutes the great difference between men's minds? Is it the scholastic discipline to which they have been subjected, or the mental culture they have expended on themselves? Is it the routine tasks, the garbled

exercises, the packed and crammed for themes, the elaborated and lexiconed translations, the be-ruled arithmetic, that make a man useful in his generation, and set him in the front-ranks of the battle of life, armed and panoplied for a victorious conflict? It is no such routinism, no such filtering of other men's ideas, no such garbled uses of other men's labours, no such formulary prescriptions for the operations of the intellect; it is from a man's own observations, from the digested operations of his own intelligence, from his self-culture, and self-discipline, the man must conquer a position, and work out his usefulness.

Granting that physiology teaches a great lesson, well worthy of being universally known, and widely profited by, when she tells us that the nervous organism suffers from a premature use of any of its endowments; and that the views that have been taken, as to the successive developments of its several parts, of the order of such developments, of the gradual use to be made of them successively, are essentially correct,—the effect of neglect of these great organic requirements, or of a sedulous fulfilment of them, is readily illustrated. The nervous exhaustion, early death, or eventual mediocrity of intellect and character, of those who are marked by intellectual precocity, and many a case of cachectic degeneration, may be partly referred to premature efforts to educate the faculties, or to the disproportionate intellectual exertions required. It would be safe, and indicate a true wisdom, to class all cases of precocious intellect

as being *primâ facie* evidence of undue excitability of the brain, which should be treated on exactly the same principle as the same condition of any other of the bodily organs. If the eye were thus affected, it would be less used, lest the excitability should lead to irritation, and this to disease; and the same observation is essentially applicable to the case of the brain, with the additional risk, that the diversion of so much nervous power to the purposes of the intellect, might so far diminish the amount of nervous power needful to the organic necessities of the system, as to lead to disorder and disease of other vital organs. And a lesson might be derived from noticing the damaged health of many a boy and girl in their teens; supposing them to have escaped from all the perils of an earlier caehexia: tracing the ailings of a period, that should be marked by peculiar health, and peculiar physical capability, to the unwise diversion of nervous powers in the intellectual exertions, from the no less important business of building up firm and strong systems, fit to encounter the wear and tear of existence. Much of the dyspepsia, the biliousness, the headaches, the palpitations, the sensitiveness to cold, the shortness of breath, the incapability of sustained exertion, and the eventual hysteria, ehlorosis, spinal curvature, and final disease of heart, lungs, or brain, that occurs between puberty and the age of forty years, may be directly referred to the premature and undue use of the faculties of the mind, without reference to the development and condition of the nervous organism, or to the powers

and requirements of the system at large. It has been well noticed, in illustration of the effects of an unwise or a premature exercise of the intellect, that Tasso, at the age of twenty-two, was the author of the greatest epic poem of modern times, but was always melancholy, or else devoured by passion, and died at the age of fifty-one; that Pascal, who also enjoyed a premature celebrity as an author, was always hypochondriacal, ever imagining that he saw a gulf open at his side, and died at the age of thirty-nine; that Byron, who wrote so early, and so much, and so greatly as to originality and high desert, and in part so unhealthily and unwholesomely, was the victim of dyspepsia and hypochondriasis, and died, of diseased brain, in his thirty-seventh year; that Pope, who notoriously began to write poetry at twelve years old, and became famous at sixteen, was the victim of extreme feebleness, morbid sensitiveness to cold, dyspepsia, headache, and eventual dropsy, whose life is well characterised as having been one long disease, and that he died in his fifty-eighth year. And an early precocity is no necessary condition of genius or intellectual eminence in the after-life; for the youth of Sheridan was pronounced to be "dull," and that of Goldsmith "unpromising." In his boyhood, Sir Isaac Newton was "inattentive to study, and ranked very low in the school until the age of twelve;" in his boyhood, Napoleon was in no way distinguished from other boys; in his boyhood, Sir Walter Scott gave no indications of his future eminence; in their boyhoods, neither Shakespeare, nor Gibbon, nor Davy, appear

to have exhibited even the common elements of future success. Such lists may be easily extended, by reference to the biographies of eminent men; and it will be found, that, to restrain precocity instead of encouraging it, should be the continual endeavour; that the more feeble, delicate, and cachectic the child's constitution, the longer should the intellectual or scholastic education be deferred; and that the mere circumstance of a slow and tardy development of the intellectual powers, affords no certain indication of the future capabilities of the mind. During the last year or two of the school-time, more is often gained, as to progress and capability, than during all the preceding years of life.

There is no room for doubt, that the use of the faculties of mind, if neither premature nor excessive, neither antecedent to the due development of the system, nor in degree beyond its strength, necessarily promotes the health, vigour, and life-probability. The exercise of the mind is capable of producing the most useful effect on the whole system, of serving as a stimulus to all the organic processes, of benefiting the condition and powers of the motor system, of promoting nutrition, usefully increasing the expenditure, diminishing congestive and plethoric tendencies, and largely conducing to the general health. The due exercise of the mind may subserve as much the organic economy, as the use of the locomotive powers notoriously contributes, if not excessive in its degree, to the activity and equilibrium of the mental endowments. The character of a child's system may be

sluggish, the organs may be prone to become congested, the physical development may be slow, or even seem to be stationary, until the spur of intellectual occupation arouses the whole economy into a more active, and advancing, and healthy condition. That the expectation of life, and the healthiness of its character, are increased by due exercise of the mental faculties, is in some degree proved by the longer lives of the intellectual classes; although this must be largely referable to other causes likewise; among which the diminished dependence on sensual indulgence for the means of happiness, deserves an important position. The growth of general intelligence, the advancing appreciation of intellectual pleasures, the increasing cultivation of the taste, has not only diminished the general intemperance; but, in this and in other ways, must have contributed to the doubling of the probable expectation of life in London, within the last century; and have aided in lowering the general mortality of this kingdom by not less than one-fourth, during the same period.

The three great classes of endowments by which the mind of man is characterised, must not only be called into exercise according to their progressive development, but must continue to be made use of in due proportion and relation to one another, if the conditions of health and long life are to be truly fulfilled.

If the sentiments and the intellectual faculties are inadequately cultivated and exercised, in the same proportion is the individual the slave and the victim

of his propensities : sensual indulgence becomes the passion and object of existence ; the restraints of the moral nature and the higher intelligence are so far insufficient for the regulation and controul of the appetites ; and the man becomes a sot, or a glutton, or something worse. Living as it were for the gratification of the propensities, they become his only source of happiness ; having no higher object for which to live, no just sense of the consequences, no restraining thought of the injury he must be doing to those around him, no abiding or controlling feeling of the wrong done to those dependent upon him, no realisation of his worse than useless life and character, he may be justly said to be living for himself alone,—if indeed it be to live for himself, to sacrifice all the objects and privileges of his being, for the sake of revelling in species of enjoyment that the very brutes have in common with himself. And the miserable game is soon played out ; the health falls a victim to the excesses ; all the physical powers are weakened ; the functions become disordered ; some of the vital structures become disorganised ; and, no longer able to find happiness or consolation in the indulgence of the favourite propensity, the man sinks, gradually sinks, disappointed and miserable,—and it may be dies unpitied, as he must die degraded,—having been worse than useless in the great hive of society.

An excessive use of the moral or of the intellectual faculties, is no less certain to be followed by injurious consequences. In these instances, as in every

instance, an excessive use of some of the faculties involves an insufficient use, and indeed a deficient power, of the other faculties; and is always followed by corresponding injury to the health and the happiness. It is plainly and pointedly enjoined, that man shall use every faculty and every function that has been given to him to a certain prescribed degree; that every deviation from this rule shall be visited with a distinct and marked warning; and that an adequate punishment shall follow a continued imperfect use, or a continued excessive use, of any of the faculties: every important deviation from the rule, involves its award of risk and of penalty.

The negligent use, or the imperfect use, of the intellectual faculties, renders man the prey of the propensities or the sentiments; and the influence of the former of these is the more likely to preponderate. To raise the moral feelings to the height which they ought to occupy in the mind of man, and to keep the animal propensities sufficiently far beneath them, used but controlled, subjected fully to man's higher nature, the exercise of the pure faculties of the intellect is necessary and indispensable; and the man who neglects such due use and exercise of the intellectual faculties is in much risk of becoming victimised to an undue development of the propensities or the sentiments, and of becoming a glutton, or a drunkard, or a debauchee, or a miser, or cruel, quarrelsome, or cowardly. Should circumstances—the influence of religion, or example, or station—check and control such abuses of the

propensities; the first of these alone can securely tie the man to the constant observance of such deencies and proprieties of life, and keep the propensities in adequate subjection, in the absence of the controlling power of an exercised intelligence; and then only if the religious sense be deep, pure, and abiding. Supposing that the individual has the highest degree of vigour of the moral sentiments that can exist, without the developing and guiding influence of a practised intelligence, and there is much risk of enthusiasm and of bigotry; the man becoming, perhaps, a self-willed and obstinate devotee to any opinion or line of conduct he may have embraced,—a blind slave to either the wrong or the right, just as it may happen to be the side on which he has earliest enlisted himself; or he is, perhaps, a creature of the imagination, a day-dreamer, to the extent of shutting out the realities of life, and neglecting its duties; or he is, perhaps, thoughtlessly prodigal, giving without judgment, or spending without a care for the future.

An excessive use, or rather abuse, of the intellectual faculties, is little less injurious to health and happiness. Such abuse of the intellectual faculties diminishes the desire for the exercise of the propensities, and in some important degree also for the exercise of the sentiments; or certain of the sentiments or propensities may be exaggerated or distorted, by being viewed through the predominant intellectual faculties, or by being acted upon and influenced by them; and bodily exercise may be

neglected ; or the food may be devoured indifferently and mechanically, without reference to its kind or its quantity ; or the food may be taken most irregularly, or at unwise intervals of time ; or the amount of sleep that is taken may be much too small ; or the clothing made use of may be disproportioned to the climate, or the season,—not to mention its possible unsuitableness to the station and circumstances of life ; or even the ordinary ablutions may be neglected ; and absence of mind, slovenliness, &c., unfit the man for the relaxations and the benefits of social intercourse, deprive the world of the personal services of so practised an intelligence, and the individual of all the reciprocated benefits of direct communion with other minds ; and the probable results of a neglected physique and an unrelaxed mind, are a sickly life and an early grave.

It might be interesting and instructive, to observe the characters of the great and the powerful, whether for good or for evil, who have graced or dishonoured the world ; to class them under these several heads ; to trace where they have erred, where they have wandered from the plain rules of nature ; and to see how these wanderings affected them, and the faults that were thus engendered. If we look back upon the cloistered monk, shut out from the exercise of his better animal propensities, and from the objects on which men lavish their higher moral feelings, how often do we find him—from the undue exercise of the intellectual powers, from the exercise of certain of the animal propensities at the expense of the

others, and from the exercise of some of the moral feelings only—characterised by bigotry, fanaticism, and intolerance, instead of by humility, loving-kindness, and charity. If we look back upon the mailed and hardy warriors of the middle ages, how often do we find them—from an undue use of the propensities, at the expense of the intellectual and moral powers—cruel, grasping, vindictive, and debauched; restrained chiefly by the code of knightly honour, which had been produced by the partial exercise of some of the higher faculties of mind, triumphing over the vast load of appetites and passions that had threatened to annihilate them. In the history of ancient Greece, we see the people at the first obedient to the great demands of nature, and find them intellectual, moral, and brave; by degrees, from the moral feelings becoming preponderant, becoming zealots in the worship of their gods, and eager followers after everything that might sufficiently stimulate the abused moral sentiments; and at length, from the propensities getting the mastery, becoming luxurious, debauched, depraved, and cowardly. History, biography, and indeed the experience of every man's life, afford amplest materials for illustrating and enforcing the same great truth.

We are bound, then, to govern our appetites, to restrain our passions, to subjugate the animal to the intellectual nature, but to use duly and equally all the powers with which we have been gifted, not only by Divine command directly revealed to us, but by the same command indirectly manifested in the

adaptation of our physical system to the ways of temperance, activity, and virtue. The man who so lives, is not only acting for his happiness in another state of being, but is securing for himself the greatest possible chance of health, length of days, and real happiness, in his present state of existence ; and the man who pursues the courses of intemperance, irregularity, and vice, is heaping coals of fire on his head in this world as well as in the next. An improper use of our powers, whether mental or bodily, is ever attended with a degree of retribution, even in this world, that is little dreamed of by the man who is ignorant of the mighty instrument of reward and of punishment, that the strict enforcement of the organic laws becomes in the hands of the Omnipotent.—

Sapere aude :

Incipe. Vivendi recte qui prorogat horam,
Rusticus expectat dum defluat amnis ; at ille
Labitur et labetur in omne volubilis ævum.

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